NutriDose II *b*
Manual

Computerized
Nutrient Management Controller

- **Fertigation using batching tank**
- **Expandable – up to 30 zone**
- **Smart irrigation triggering (Solar integrator PLUS)**
- **Two different nutrient mixes selectable**
- **Data logging**
- **Remote operation**
- **Nutrient (Root Zone) Heating/Cooling**
- **Misting / filter back flush function**

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1 Overview

The NutriDose II ***b*** is a computerized, feature packed, batch fertigation controller for up to 30 irrigation zones or stations. Irrigation zones can be added in modules of 10. Each of the 30 zones can have its own solar integrator, which may be modified for temperature, relative humidity and, in the case of outside zones, wind and rain. In addition, up to 8 irrigations per day can be programmed to occur at a specific time of day. This is useful for forcing irrigations to occur during the evening, night and early morning. It is often used to schedule two waterings, close together, just as the sun is rising and then immediately switching to automatic scheduling using the solar integrator. This ensures all pots start the day full.
Programmed irrigations can individually select from mix1, mix2 or water-only and each zone can have a different EC for mix 1 and for mix 2. The ability to select different mixes in this way is useful to provide a special mix in the evening perhaps containing extra calcium or other additive or else a different mix for some zones where a different crop may be grown.
During the time zone when the solar integrator is active, it is possible to allow the EC to automatically adjust to suit the weather conditions. In sunny weather the EC will automatically be lowered to allow rapid transpiration, whilst in cloudy weather the EC is raised to help avoid the plants becoming spindly. The extent that this can happen and the rate at which the EC can change are fully programmable and each zone can be set to work between different EC limits.

The controller can be set to operate in one of three possible modes

Irrigation modes:-
1) Single trigger – single batch
In this mode one large tank is dosed and fed sequentially to all zones. Each zone receives the same EC, pH and recipe. Either mix1, mix2 or plain water may be selected for day (solar time zone) and for each irrigation specified during the night (programmed time zone)
2) Single trigger – multiple batch
In this mode a single trigger causes all irrigation zones to be sequentially watered from a small tank which is refilled/dosed for each subsequent zone in turn. This allows the grower to specify a different EC and pH for each zone. In addition, each zone can be dosed from one of two different mixes or by plain water.
3) Multiple trigger – single batch
This mode is normally used in conjunction with "continuous dosing" so that a large tank is continually filled by float valve and is continuously dosed. Then at any time, a zone can be triggered and immediately irrigated. Obviously, in this mode all zones will receive the same pH, EC and mix, the only difference between zones is their triggering and duration.
4)Multiple trigger – multiple batch
Here, each zone has its own trigger point and when triggered the tank is dosed and fed to the zone corresponding to that trigger. Note that only one zone is irrigated, the tank is then refilled and waits for another trigger to occur. This mode affords the greatest level of flexibility as now it is possible to mix different crops that require quite different watering/feeding regimes and even inside and outside crops can be served by the one controller. Outside zones are triggered from an outside weather station that takes into account solar, temperature, humidity, wind speed and rainfall.

Dosing

The controller has four timed outputs that can be used for A and B fertilisers, acid or alkali. The controller can be set to use the main pump to stir the tank during dosing. When dosing, one of two sets of stock solution can be selected from. This is useful for applying a special additive once per day, for having a different recipe for night feeding or even a different recipe for different crops on different zones.

Filter backwash

When set for filter back flushing, the controller will flush the filter at times when irrigation is not active. If an irrigation is triggered during a backflush, the flushing will complete and then immediately switch to irrigation.

Filling

The NutriDose II *b* can be set to fill as soon as an irrigation has been completed or alternatively when an irrigation trigger is received. This is useful when solar heating is used to pre-warm the water just before use.

PC connection

The controller may be connected to a PC computer for setting, data logging and alarms. The PC provides a very user-friendly interface although it is possible to set and use the controller completely stand-alone. The PC interface also provides remote alarms and data/event logging. The PC interface is highly recommended as it provides much more information to the grower and also a much simpler interface. The same Compugrow software, interface and cable can also be used to connect to other Autogrow control and monitoring devices.

Input modules:-

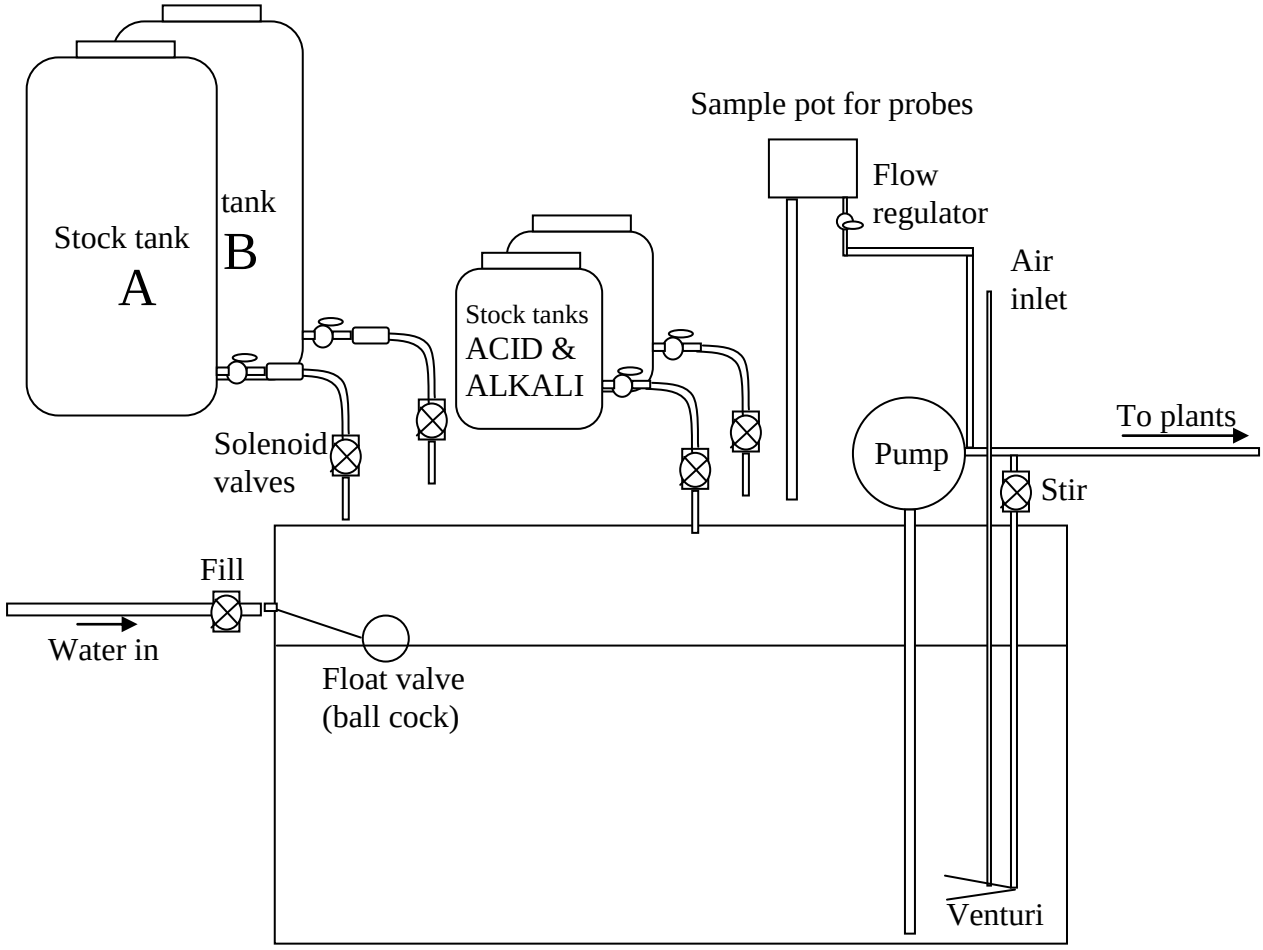
The inputs used will depend on the type of operation required. For instance, if some zones are out in the open then an external weather-station is required. If some irrigation zones are inside a greenhouse then an internal environment sensor system is needed. If an Autovent2 or 3 is used to control the greenhouse environment then all of this information is available from the Autovent. If volumetric ratio injection is required or if the user requires monitoring of water and/or chemical usage then a water meter and/or fert flow meters together with a flow meter interface module is required. If feedback injection is required then a nutrient sensor module is required.

Outputs:-

All outputs to solenoid valves or relays are 24V AC and limited to a peak output of 48VA and continuous operation of 24VA.
All outputs have toggle switch overrides to allow manual operation.
Data communications to the PC, internal environment box, weather station, environment controller etc is by industry standard RS485 connection. All long haul bus connections are optically isolated to try to prevent the propagation of induced voltage surges through the data network.

2. System Layout suggestions

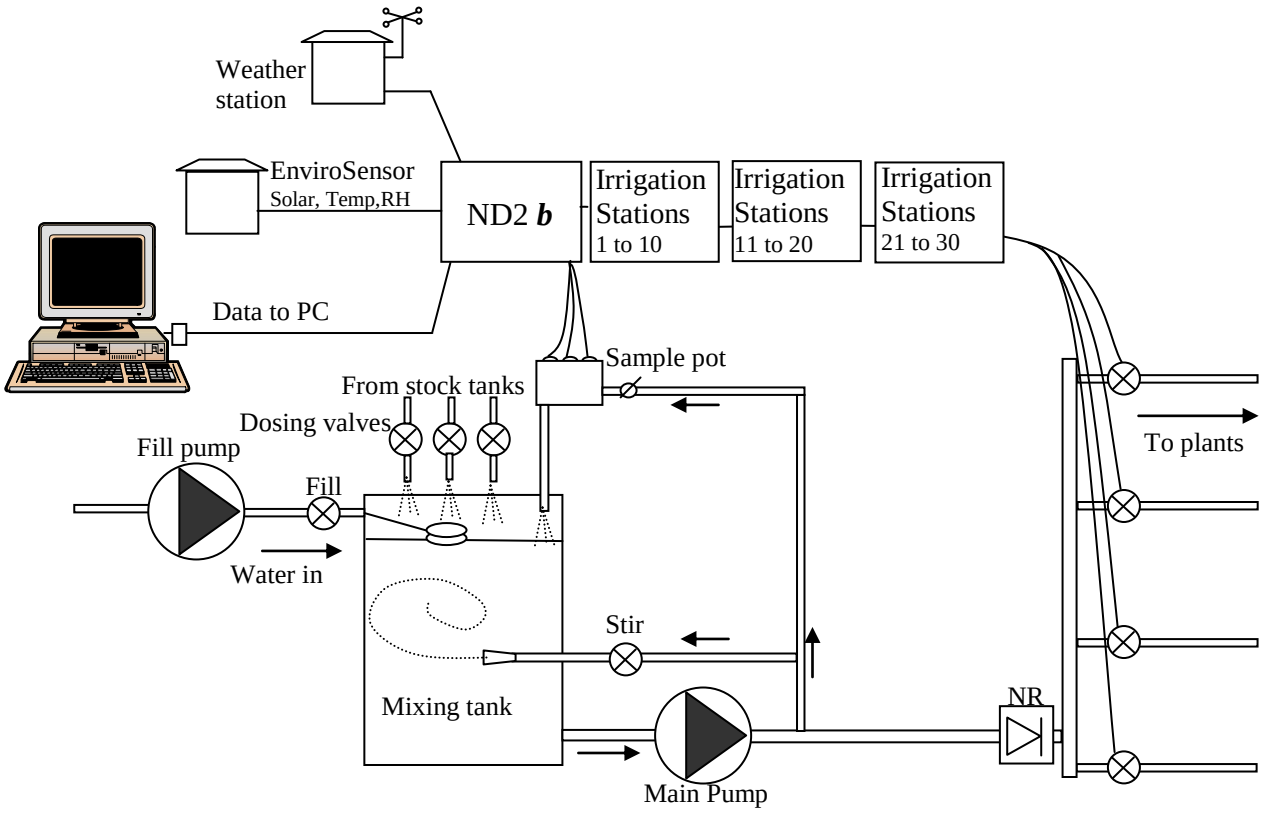
2.1 A simple gravity fed system



Gravity fed systems are most convenient when the batch tank is underground. This allows the A & B stock tanks and the acid/alkali tanks to be located at ground level where it is convenient for replenishing and mixing new stock solutions.

Where the batch tank is above ground then there are two possibilities. One is to use dosing pumps such as peristaltic pumps and the other is to use small centrifugal pumps to fill "day tanks" once each morning (from a time switch). These pumps may also be used to help with mixing and the use of day tanks can help minimise risk due to a valve, sensor or controller malfunction as these can be sized so that if the total contents was dosed, the plants would survive. If used for mixing the fertilizer, the pumps should be reasonably chemically resistant and capable of handling some solid lumps of fertiliser. Wastewater pumps will be often suitable in this application.

2.2 Complete batch system



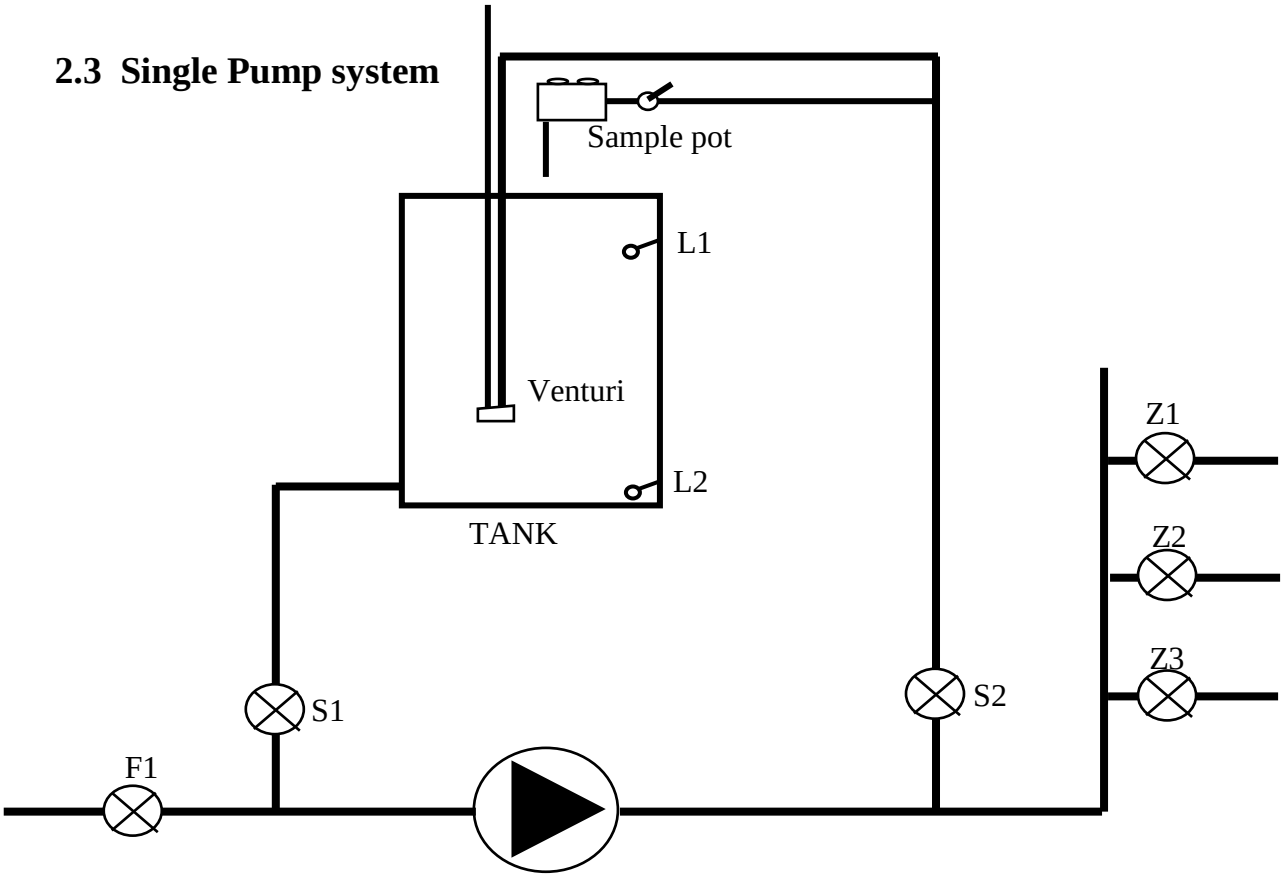
Batching System

This example system uses a turbulent mixing tank to ensure thorough mixing of the nutrients and pH corrector. The nutrients and pH corrector may be gravity dosed via solenoid valves or else pumps may be used. It is possible to vary this layout to use a single pump for both filling and irrigation by a system of solenoid valves which redirect the water flow. The diagram below shows how this can be achieved

Notes:

1) The dosing valves or pumps must be large enough to complete a dose in a reasonable amount of time. If you have many irrigation zones then this time becomes more critical
2) Two different fertiliser mixes may selected for each zone day and each zone night, solenoid valves select which tank is required (any combination)
3) The main pump must be able to withstand dilute fertiliser and pH chemicals

2.3 Single Pump system

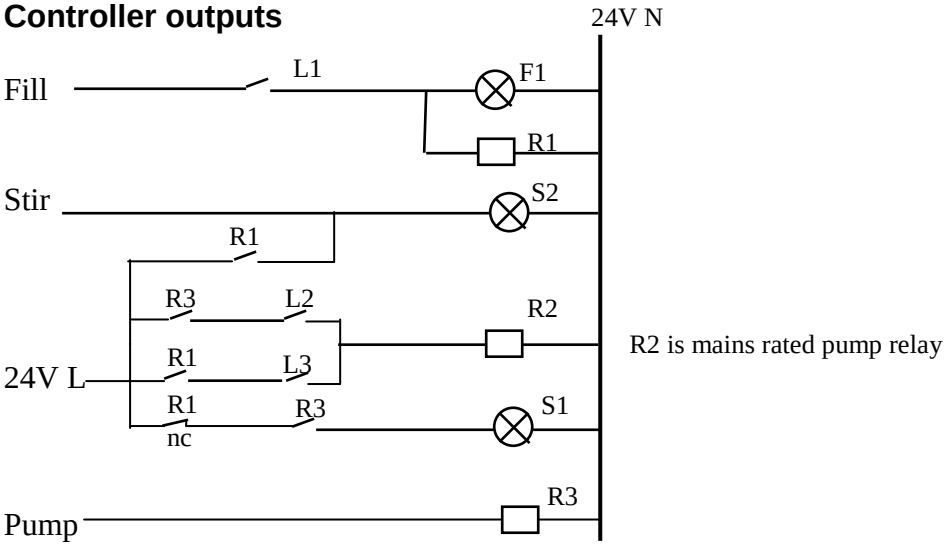


System layout using one pump for fill, stir and irrigation

Legend

F1 Fill solenoid valves
S1 and S2 Stir solenoid valves
Z1, Z2 and Z3 Zone irrigation valves
L1 High level float switch (open when high)
L2 Low level float switch (open when low)
L3 Low level float switch in supply tank (open when low)

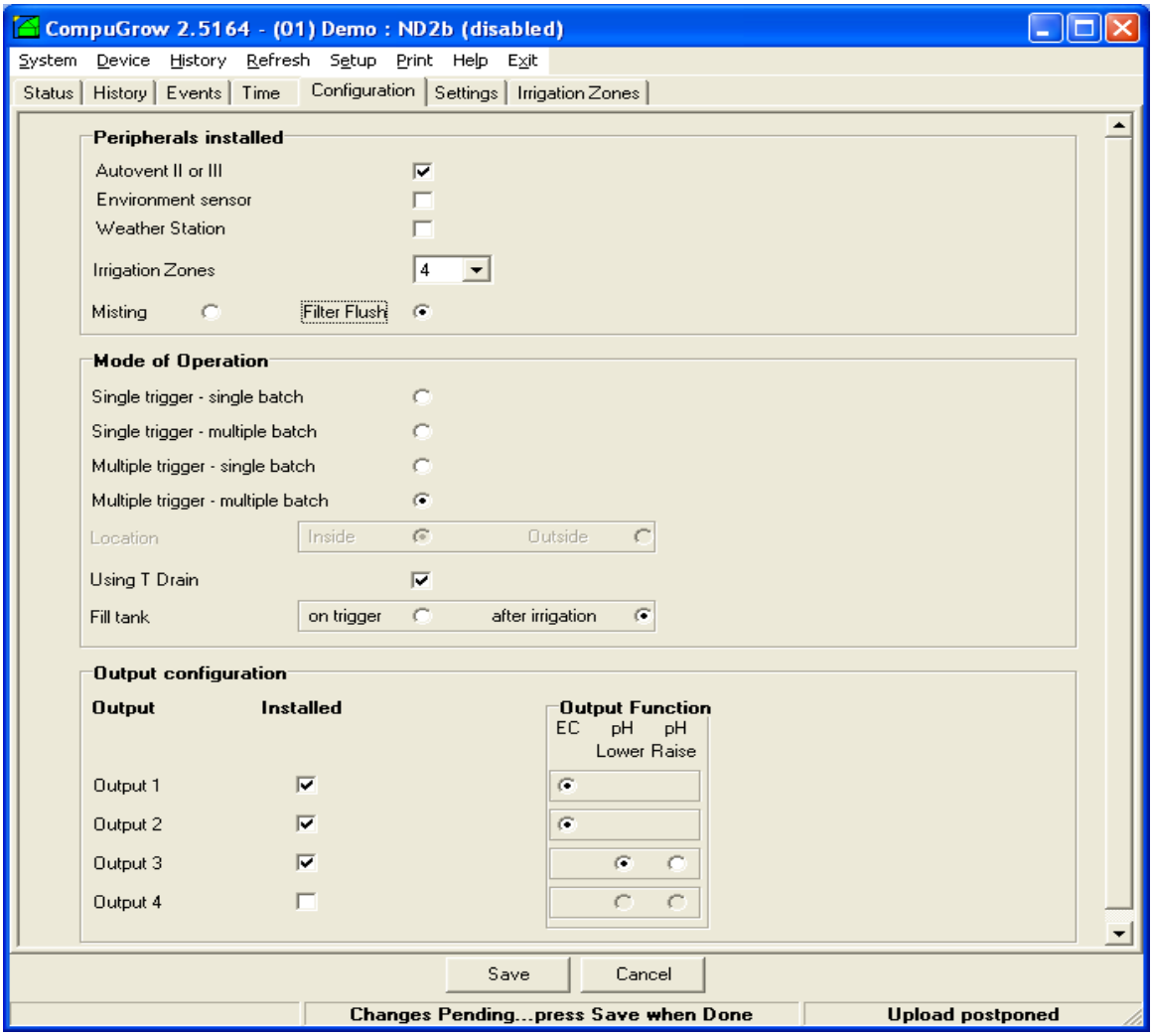
Controller outputs



The 24V AC L and 24V AC N must be obtained from the NutriDose II and NOT from and external source

3 General settings for all users

3.1 Configuration



Configuration is necessary to tell the controller what peripherals are attached and in some cases their characteristics. The following description follows the order that these settings are found in the PC configuration and settings tabs. Similar settings will be found within the controller menu system.

1) **Peripherals installed.**
You must specify which peripheral modules are connected. These include the inside environment interface, ES; the outside weather station, WS; the flow meter module and a main water meter with electrical (pulse) connection. Alternatively, the environment (both in and out) can be obtained from an AutoVent II or AutoVent III controller. If a water meter is connected then you will also need to specify the pulses per 100L that it produces. In addition you must specify the number of irrigation zones or stations that will be used and whether the auxiliary output will be used for misting or filter backflush

2) Mode of operation

Select from:-

1) single trigger – single batch
2) single trigger – multiple batch
3) multiple trigger – multiple batch

For modes 1 and 2 a single irrigation trigger (from the solar integration system or a time-of-day programmed irrigation) will cause all irrigation zones to be watered in sequence. Mode 1 will water all of these zones from one large tank of water without refilling between zones whilst mode 2 will refill and remix for each zone. Mode 2 allows each zone to have a different EC and mix selected.
The most versatile of the modes is mode 3 - multiple trigger – multiple batch. This allows each irrigation zone to have its own trigger point, its own EC and even its own mixture (selected from a choice of two mixes). It also allows inside and outside zones to be mixed at will. This mode can only be selected if solar information is available (from an AutoVent, Enviro sense or weather station).

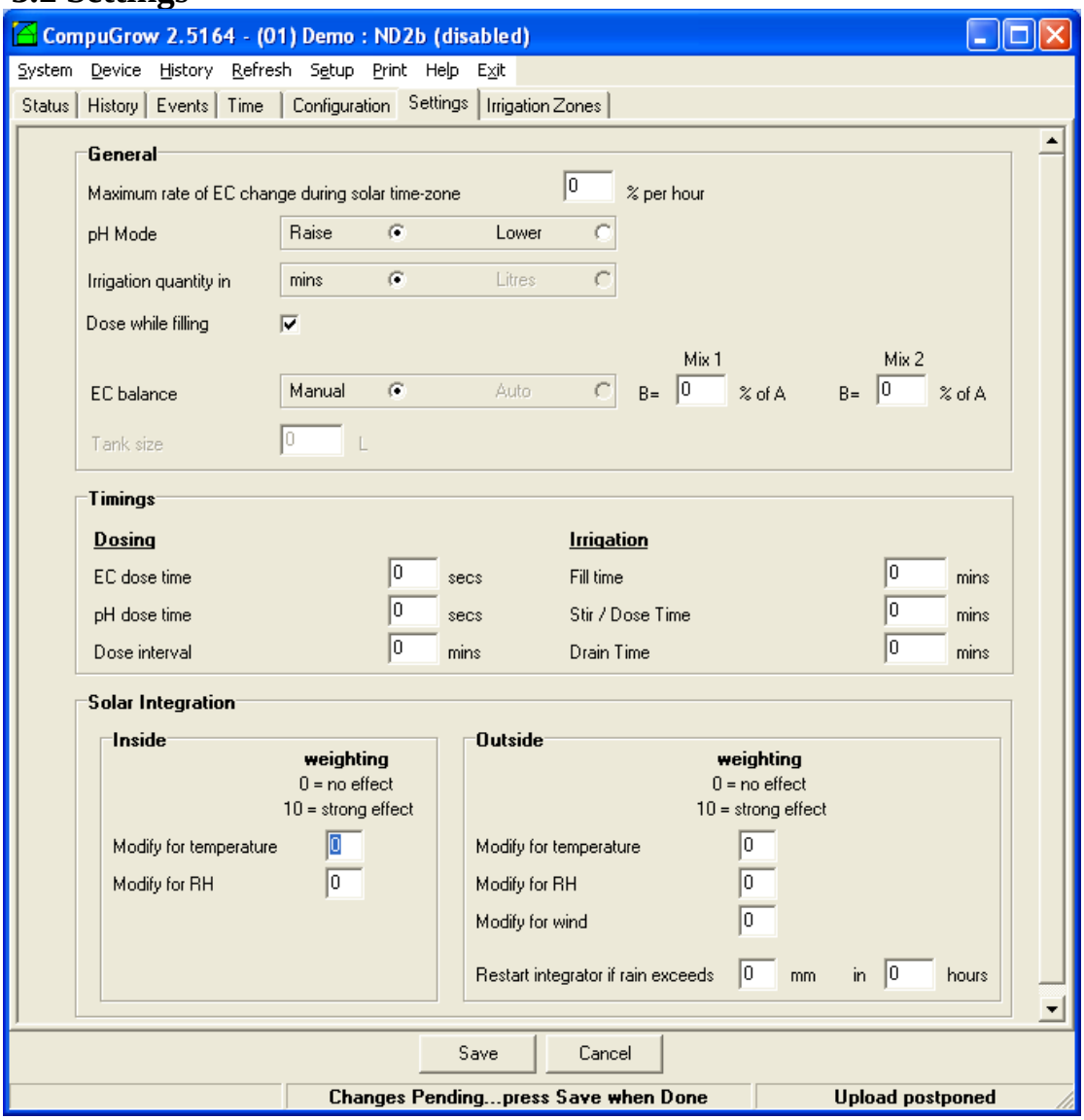
If mode 1 or 2 has been selected then you also need to specify here whether the zones are inside or outside – they cannot be mixed

You may specify here if you wish the tank to be refilled with water immediately after an irrigation or when an irrigation trigger occurs. This is useful when heated water is used for the irrigation as it will fill, dose, stir and then immediately irrigate.

3) Output Configuration

Output configuration tells the controller if it has a dosing pump/valve for each of the outputs, if it has a flow meter, if so what its count per 10L of water is. It also tells it what the function the output will perform and the type of output device that is connected. Also, notice that certain outputs are restricted to particular functions for example if output 1 is selected for EC dosing then output 2 will automatically be allocated to EC as well. To select “volumetric ratio” or “bulk” function, a flow meter module and flow meter must be installed.

3.2 Settings



1) General

The EC can be allowed to automatically adjust to suit the weather conditions during the day (solar) time zone. Obviously, you will not want it to vary every time a cloud passes by and so you can set the maximum rate at which it can adjust the EC. By setting it to say 0.1mS/cm per hour, it would take at least ten hours of continuous full sun or continuous heavy cloud to change the EC by 1.0mS/cm.

The pH mode for all zones must be set to either lower (acid) or raise (alkali) and this must correspond with the actual solution connected.

The method for specifying quantity must also be specified here. If a water meter is fitted then you can specify the quantity in Litres, otherwise it must be in minutes and seconds

If mode (1) is selected then you will need to set pH here as well otherwise pH will be set in the zone setting tab

The EC balance setting allows you to compensate for a variance in the injection rate between the A and B stock solutions. Differences may occur for a variety of

reasons like slight differences between the pumps or solenoid valves, pipes with slightly different dimensions, kinks or deposits inside the pipe. Even if all of this is perfect a difference in specific gravity between the A and B mixes could cause a difference in dose rate. The EC balance setting allows you correct for these imbalances.

2) **Timings**

The dose times should be set so that each dose of nutrient raises the EC by 0.2mS/cm (2CF) and each pH dose changes the pH by about 0.2 pH. These times will depend greatly on the pump/solenoid valve siuzes and tank size. A reasonable starting point is around 20 seconds for nutrient and 10 seconds for pH. The dose interval should be set to the minimum time in which a dose is mixed in usually about 2 mins.

Set the fill time to a little more than needed to fill the tank from empty

Set the Stir/dose time to a little more than needed. Normally this cycle will end as soon as the setpoints are reached. This maximum time is set so that if the nutrient or acid runs out, then an irrigation will still occur even thought the set points have not been reached.

If you are collecting the run-off back into the batch tank you may want to set a small drain time to allow most of the run off to be collected before starting the next fill cycle. This is mainly to avoid overflowing of the tank due to the run-off arriving back after the tank has filled.

3) **Solar Integration**. Solar integration may be used during the day time to trigger irrigations. The concept behind this is that if the solar irradiance is high then the plants will be transpiring and so will require more frequent watering. A solar integrator is simply a counter that increments every time a certain amount of energy has been received from the sun. The brighter the sun, the quicker the integrator counts and the sooner the next watering will come around. The Autogrow solar integrator also allows you to modify the count rate for temperature and humidity so that on dry, hot days it will count even quicker and on damp or cool days it will count slower. This can be used to gain increased accuracy in watering calculation. If crops are grown outside then you can also introduce the effect of wind and rain. The weightings for these settings are determined empirically and will require some "trial and error" to set them exactly. Remember that a weighting of zero means that it will have no effect, 5 will have an average effect and 10 will give it its maximum effect. Each individual weighting has a maximum possible effect of reducing the integration to 50% or increasing it to 200%. These effects are additive within the limits of 50% to 200%..

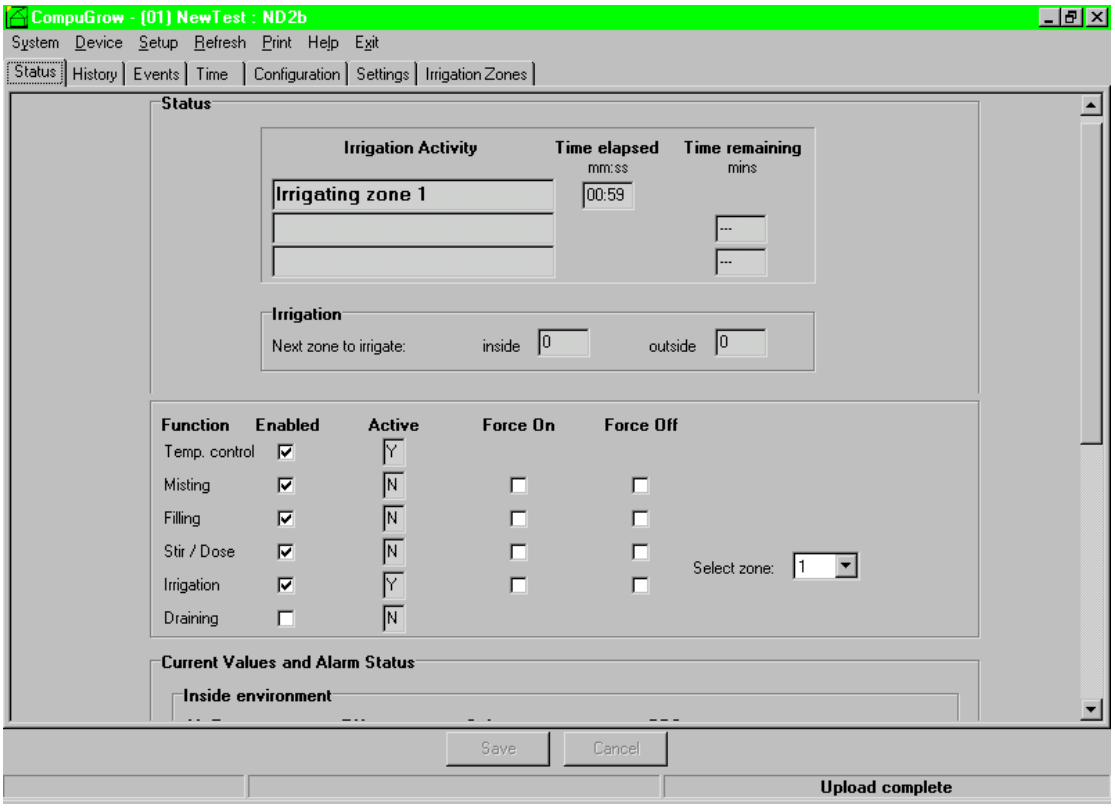
With all effects turned off, the solar integrator counts in units of mols**.** As a rough guide, on a clear day in mid summer the maximum count could reach about 40 or 50 mols in one day outside. Inside, this will be reduced to 15 to 30 mols.

The rain override simply restarts the counter from zero if the specified amount of rain is collected within the set period.

4) **Filter Back flush**

If the auxiliary output is used for filter backflush then enter the interval between flushing and the duration of the flush

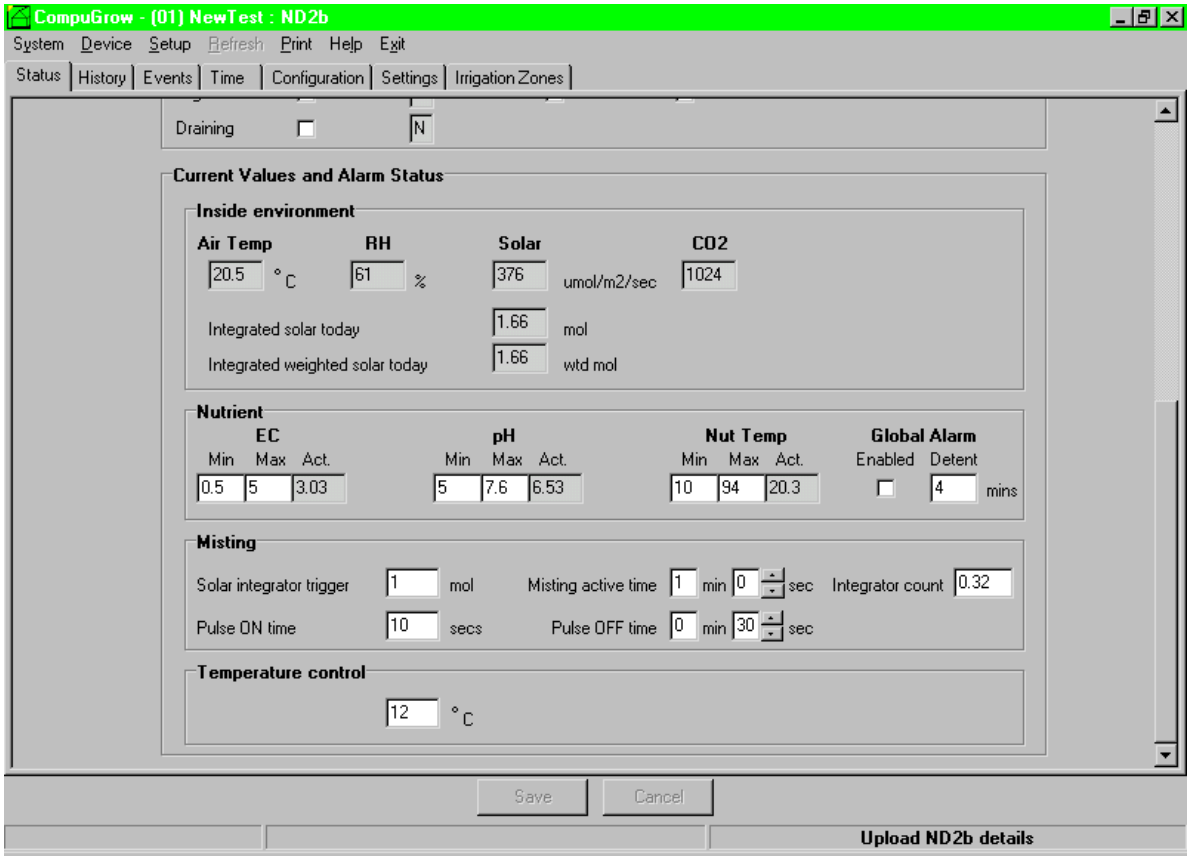
3.3 Status, current values and miscellaneous settings



In this section, most of the boxes contain readings showing the current status of the system. In a few cases, this section also contains settings.

Irrigation activity shows the current status with regard to irrigation. For example, it might say “waiting for trigger” when there is no activity or “Irrigating Zone 5” when irrigating zone 5.
This section also contains the “enables” and “force on”/”force off” switches that allow you to switch various functions on/off and also force them to be active/inactive.

Depending on what peripherals are installed and being used for irrigation triggering, this tab also shows the readings regarding inside or outside, air temperature, humidity and solar readings, solar integrations and also the relevant triggers when in mode 1 and 2. For mode 3 the trigger setting are displayed against each zone in the irrigation zone section.



The current nutrient readings together with alarm settings are also in this section. If an individual alarm is not required then it can be disabled by setting the alarm limits well away from normal operating conditions.

4 Irrigation

4.1 Settings for each of the three modes

All modes require the dosing and irrigation time settings described above. They also require that the programmed irrigations and the solar integrator period is properly specified in the time tab.

a) **Irrigation set-up in mode 1**

Mode 1 is the single trigger – single batch mode of irrigation where a large tank of water is dosed up and then when a trigger occurs, all stations are irrigated out of the single tank, one after the other. As there are only one set of settings for all zones these are set as zone 1 settings.
Also on the PC in the time tab, it is possible to specify which mix is required for each timed irrigation or for the solar irrigation and also the EC for each mix used.
The single trigger point is set in the status and current reading section above. The irrigation durations or quantities for each zone are set under irrigation zones.

b) **Irrigation set-up in mode 2**

Mode 2 is the single trigger – multiple batch mode where a small tank is repeatedly refilled and the zones are irrigated in sequence in response to a single trigger.

The trigger point is set in the status and current reading section above. The irrigation durations or quantities for each zone are set under irrigation zones. By clicking on the zone designator (ie the Z1, Z2 etc button) a screen pops up that allows you to enter for that zone the mix required (from mix1, mix 2 or plain water) and the EC to used for mix1 and for mix2 during the programmed irrigations.

c) **Irrigation set-up in mode 3**

Mode 3 is the multiple trigger – multiple batch mode where a small tank is repeatedly refilled and each zone has its own solar integrator and trigger point. As each irrigation zone has its own trigger these are set in the irrigation zone section along with all other settings specific to each zone such as watering duration etc.
By clicking on the zone designator (ie the Z1, Z2 etc button) a screen pops up that allows you to enter for that zone the mix required (from mix1, mix 2 or plain water) and the EC to used for mix1 and for mix2 during the programmed irrigations.

4.2 Irrigation Zone Settings

The settings in this group depend on the mode selected. Jump straight to the mode that you are using

Mode 1 (single trigger – single batch)

1) Check *Irrigation enabled* to allow irrigation or uncheck to stop this zone from irrigating
2) Check *dosing enabled* to allow fertigation to take place or uncheck to irrigate with plain water
3) Specify *Irrigation Quantity* for this zone either in quantity (Litres) or time (mintes:seconds) (as specified in *configuration)*

Finally, you need to specify the extended set-up values for each zone. To activate the extension window, click on the zone name button at the beginning of each row.

– Check (tick) if *zone is outside*
- Select from *mix 1 or mix 2* for *day (solar integrator) time zone*
- *For the programmed irrigations, specify the EC to be used for mix 1 and mix 2*
- *Then for each programmed irrigation, specify the whether to use mix 1, mix 2 or water only*
- Check (tick) if *this zone is a Tee tape drain zone* (see below*)*
- Specify which *zone is Tee tape drain for this zone* (if there is one)
– Check (tick) if this *zone valve is to open during Tee drain time*
- *A zone nominated as a T drain zone will have all of its setting boxes grayed out except for the quantity (which must be specified in minutes)*

Remember to save all settings before leaving the current tab

Mode 2 (single trigger – multiple batch)

1) Check *Irrigation enabled* to allow irrigation or uncheck to stop this zone from irrigating
2) Check *injection enabled* to allow fertigation to take place or uncheck to irrigate with plain water
3) Specify *Irrigation Quantity* for this zone either in quantity (Litres) or time (mintes:seconds) (as specified in *configuration)*
4) Specify the *trigger count* ie the solar integrator value at which you want an irrigation to occur
5) The *Integrator Count* value shows you the current value in the counter. Normally you will just read this value but you can overwrite it if you wish. When this count reaches the trigger count an irrigation will be triggered and the Integrator count will reset back to zero.
6) The dosing *output setpoints* must now be entered. The format that these will take depends on the output functions specified in the configuration tab. For example if outputs 1 and 2 have been allocated to EC injection then these windows will be blank and you will need to click on them to enter a pop-up "extension" window that allows you to enter the various EC values. Similarly, if an output is allocated to pH lower, you will be asked for the pH lower setpoint. Note that if an output has been allocated to pH raise and another to pH lower then you will be prompted for a pH lower set-point and a pH lower set-point. These however, must be the identical.

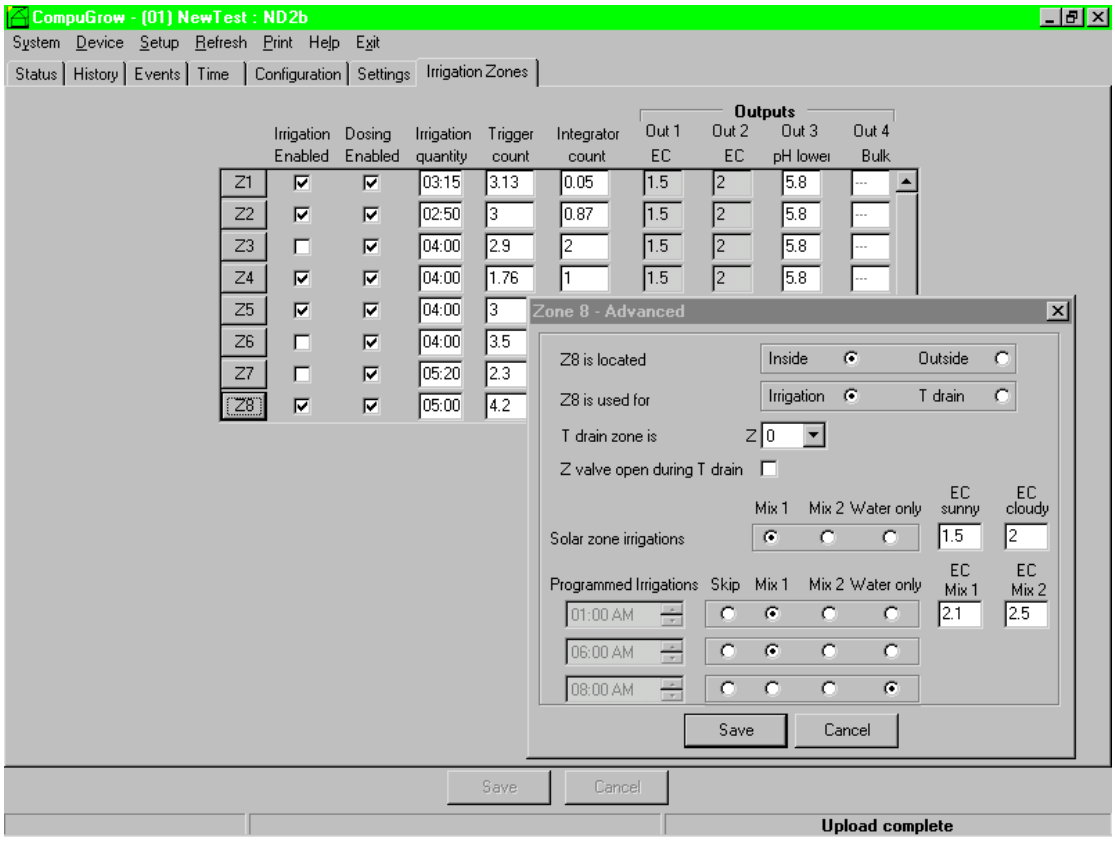
If an output is allocated as a volumetric ratio output then you must enter the Ltrs per 100L of water that you require. Similarly, for a bulk output, you should enter the total ltrs of additive required or the total time of injection if a fert flow meter is not used.

Finally, you need to specify the extended set-up values for each zone. To activate the extension window, click on the zone name button at the beginning of each row (or the EC windows).

– Check (tick) if *zone is outside*
- Select from *mix 1 or mix 2* for *day (solar integrator) time zone*
- *For the programmed irrigations, specify the EC to be used for mix 1 and mix 2*
- *Then for each programmed irrigation, specify the whether to use mix 1, mix 2 or water only*
- Check (tick) if *this zone is a Tee tape drain zone* (see below)
- Specify which *zone is Tee tape drain for this zone* (if there is one)
– Check (tick) if this *zone valve is to open during Tee drain time*
- *A zone nominated as a T drain zone will have all of its setting boxes grayed out except for the quantity (which must be specified in minutes)*

Remember to save all settings before leaving the current tab

Mode 3 (multiple trigger – multiple batch)



1) Check *Irrigation enabled* to allow irrigation or uncheck to stop this zone from irrigating
2) Check *injection enabled* to allow fertigation to take place or uncheck to irrigate with plain water

3) Specify *Irrigation Quantity* for this zone either in quantity (Litres) or time (mintes:seconds) (as specified in *configuration)*
4) Specify the *trigger count* ie the solar integrator value at which you want an irrigation to occur (For modes 1 and 2 this will be done in the Status tab)
5) The *Integrator Count* value shows you the current value in the counter. Normally you will just read this value but you can overwrite it if you wish. When this count reaches the trigger count an irrigation will be triggered and the Integrator count will reset back to zero.
6) The dosing *output setpoints* must now be entered. The format that these will take depends on the output functions specified in the configuration tab. For example if outputs 1 and 2 have been allocated to EC injection then these windows will be blank and you will need to click on them to enter a pop-up "advanced settings" window that allows you to enter the various EC values. Similarly, if an output is allocated to pH lower, you will be asked for the pH lower setpoint. Note that if an output has been allocated to pH raise and another to pH lower then you will be prompted for a pH lower set-point and a pH lower set-point. These however, must be the identical.

   If an output is allocated as a volumetric ratio output then you must enter the Ltrs per 100L of water that you require. Similarly, for a bulk output, you should enter the total ltrs of additive required or the total time of injection if a fert flow meter is not used.

Finally, you need to specify the advanced set-up values for each zone. To activate the extension window, click on the zone name button at the beginning of each row (or the EC windows).

– Check (tick) if *zone is outside*

- Select from *mix 1 or mix 2* for *day (solar integrator) time zone*

- *For the programmed irrigations, specify the EC to be used for mix 1 and mix 2*

- *Then for each programmed irrigation, specify whether to use mix 1, mix 2 or water only or whether to skip the irrigation for this zone*

- Check (tick) if *this zone is a Tee tape drain zone* (see below*)*

- Specify which *zone is Tee tape drain for this zone* (if there is one)

– Check (tick) if this *zone valve is to open during Tee drain time*

- *A zone nominated as a T drain zone will have all of its setting boxes grayed out except for the quantity (which must be specified in minutes)*

Remember to save all settings before leaving the current tab

Tee Drain function explained

When drip tape (Tee tape) is used over a row of boxes or pots, the row normally is positioned on a slope so that any run-off will run to one end for collection. This also means that the drip tape will lie on a slope with one end higher than the other. When an irrigation is complete and the irrigation zone valve closes, the drip tape is left full of water. This water left in the tape will tend to run down to the lowest end of the tape which will continue to drip for some while after the upper end has stopped. If this is allowed to happen then the boxes at the lower end will end up much wetter than those at the top and will tend to suffer from disease problems. To help prevent this the zone drip tape can be drained by opening a valve connected to its lower end. This is achieved by allocating one of the other zones as its T drain zone. In addition the zone nominated as T drain zone must also be configured as such. The drain water from the tapes can be collected and channeled back to the batch tank.

Usually each drip tape zone has its own drain valve but the ND2b provides a lot of flexibility in this regard

4.3 Irrigation Times and Time Zones

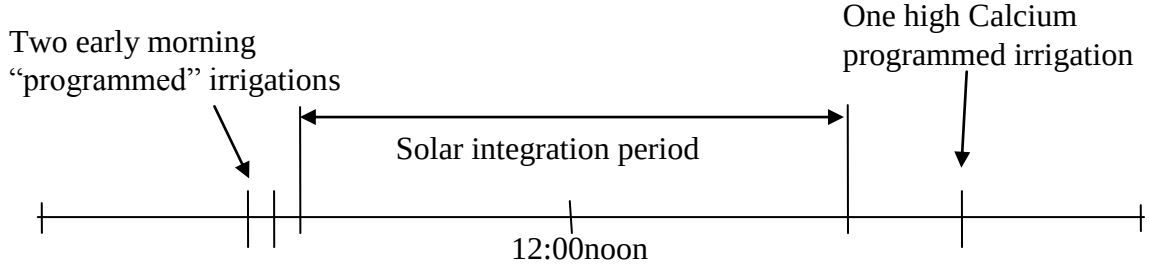
Concept:-
The day is divided into two time zones.
The first time zone is called the "solar zone" and is programmed to occur when then sun is sufficiently bright to operate the solar sensor and hence the solar integrator. During this time zone, irrigations are triggered by solar integrator.

The idea of using a solar integrator is to try to predict when the next watering is required. The concept behind this is that if the solar irradiance is high then the plants will be transpiring and so will require more frequent watering. A solar integrator is simply a counter that increments every time a certain amount of energy has been received from the sun. The brighter the sun, the quicker the integrator counts and the sooner the next watering will be triggered. The Autogrow solar integrator also allows you to modify the count rate for temperature and humidity so that on dry, hot days it will count even quicker and on damp or cool days it will count slower. This can be used to gain increased accuracy in watering calculation. If crops are grown outside then you can also introduce the effect of wind and rain. The weightings for all of these environmental effects are determined empirically and will require some "trial and error" to set them exactly. Remember that a weighting of zero means that it will have no effect, 5 will have an average effect and 10 will give it its maximum effect. Each individual weighting has a maximum possible effect of reducing the integration to 50% or increasing it to 200%. These effects are additive within the limits of 50% to 200%.. With all effects turned off, the solar integrator counts in units of mols**.** As a rough guide, on a clear day in mid summer the maximum count could reach about 40 or 50 mols in one day outside. Inside, this will be reduced to 15 to 30 mols.

Also for outside crops, the rain override restarts the counter from zero if the specified amount of rain is collected within the set period.

In the solar time zone the EC may be allowed to drift between an upper and lower limit both settable in the "irrigation zone" section. This allows the EC to fall on very sunny days when the plants need to transpire and strengthen in dull weather to help stop the plans growing spindly. The maximum rate of change that this can occur may be set in the general section under configuration. A good starting point is perhaps 5% per hour.
Outside of the "solar zone" all irrigations are programmed by time-of-day. Up to eight irrigations can be programmed this way. Normally, a few irrigations are programmed during the evening and night and then a further two waterings are programmed close together at sun-rise just before the solar zone starts. Having two waterings close together ensures that the pots start each day fully saturated.

Typical irrigation set-up



Menu System

The menus are arranged hierachically with the main menu at the top level and sub-menus below. To enter a sub-menu, position the cursor on the main menu item and press enter. Then position the cursor on the desired item in this sub- menu and press enter again to go into the even lower sub-menu. After viewing or changing a setting (using the up and down keys) press exit to leave that menu item and save any changes made. The left and right arrow keys move the cursor onto the next field (or back to a previous field) when in a screen with more than one field

MAIN MENU

Readings
Irrigation
Zones
Time / Date
Alarms
Calibration
Setup
Controller Info

ENVIRONMENT

READ Nutrient	READ Nutrient SP CF : xxx.x (xxx.x) pH : xx.xx (xx.xx) Temp: xxx.x°C
READ Enviro Summary	READ IN OUT Temp : xxx.x xxx.x RH : xxx% xxx% Solar: xxxx xxxx
READ Solar Integ	READ Solar Integ Intg Wgtd In : xxx.xx xxx.xx Out : xxx.xx xxx.xx
READ Out Wind/Rain õ	READ Wind / Rain Rain (Day): xxx mm Rain(xxHrs): xxx mm Wind Speed : xxxkm/h
READ Mist Integrateô	READ Mist Integrator Mister Integrator xxx.xx mm/m2
READ Day Flow Meter	READ Day Flow Count Main : xxxxxltrs F1: xxxxl F2: xxxxl F2: xxxxl F3: xxxxl

IRRIGATION

IRRIG Status	IRRIG Status Waiting for Trigger
IRRIG Statistics	IRRIG Statistics No.Irrigs Today: xxx Time Since Last xxx:xx (hr:min)
IRRIG Flow	IRRIG Flow Main : xxxxxltrs F1: xxxxl F2: xxxxl F2: xxxxl F3: xxxxl

ZONES

ZONE Settings (Choose No. & Enter) Zone No. : xx	ZONE XX Status	ZONE XX Status Status : Integrator : xxx.xx
	ZONE XX Control	ZONE XX Control Dose Enabled : Y Force Irrig : Y Stop Irrig : Y
	ZONE XX Solar & Time	ZONE XX Solar & Time (Min:Sec) Irrig Time: xxx:xx Solar Trig: xxx.xx
	ZONE XX O1 & O2 SP	ZONE XX EC Solar SP Sunny EC : xx.x Cloudy EC : xx.x Solar Mix : Water
	ZONE XX O3 & O4 SP	ZONE XX O3 & O4 SP O3 : pH = xx.x O4 : xxx
	ZONE XX Prog EC SP	ZONE XX Prog EC SP Prog Mix1 EC : xx.x Prog Mix2 EC : xx.x

ZONE XX Prg Tme 1-4	ZONE XX Prg Time 1-4 1) Water 2) Water 3) Water 4) Water
ZONE XX Prg Tme 5-8	ZONE XX Prg Time 5-8 5) Water 6) Water 7) Water 8) Water
ZONE XX Setup ô	ZONE XX Setup Zone Enabled : Y Zone Loc : Inside
ZONE XX Mode/Tdrain	ZONE XX Mode/T-Drain Zone Mode : TeeDrain Active Time: xxx:xx OpenVlve 4 Drain : Y

TIME & DATE

TIME Time / Date	TIME Time / Date xx:xx:xx (Time) xx/xx/xx (Date)
TIME Solar Strt/Stop	TIME Solar Strt/Stop Start Stop Time : xx:xx xx:xx

ALARMS

ALARMS Setup	ALARMS Setup Alarm Enabled : Y Alrm Detent: xx.xmin
ALARMS Enable (Flow)	ALARMS Enable (Flow) Main Flow : Y Fert1: Y Fert2: Y Fert3: Y Fert4: Y
ALARMS Settings	ALARMS Settings EC pH NTemp Min: xx.x xx.x xxx°C Max: xx.x xx.x xxx°C

CALIBRATION

NUT Calibrate EC	NUT Calibrate EC Inc/Dec Until Correct CF : xx.x
NUT Calibrate pH7.0	NUT Calibrate pH7.0 Inc/Dec Until Corrct pH : xx.xx
NUT Calibrate pH4.0	NUT Calibrate pH4.0 Inc/Dec Until Corrct pH : xx.xx
NUT Factory Defaults	NUT Factory Defaults Press Enter to Reset Nutrient Calibration

SETUP

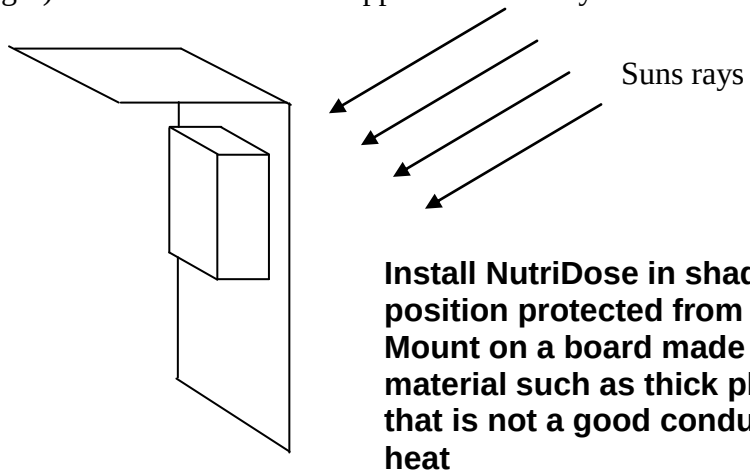
SETUP Irrigation	SETUP IRR En/No.Zns	SETUP IRR En/No.Zns Irrig Enabled : x No of Zones : xx Fill on Trigger : x
	SETUP IRR Enables	SETUP IRR Enables Fill Enabled : T Stir Enabled : T Drain Enabled : T
	SETUP IRR Prog Enble	SETUP IRR Prog Enbl 1) T 2) T 3) T 4) T 5) T 6) T 7) T 8) T
	SETUP IRR Prog 1-4	SETUP IRR Prog 1-4 Current Time: xx:xx 1) xx:xx 2) xx:xx 3) xx:xx 4) xx:xx
	SETUP IRR Prog 5-8	SETUP IRR Prog 5-8 Current Time: xx:xx 5) xx:xx 6) xx:xx 7) xx:xx 8) xx:xx
	SETUP IRR Times	SETUP IRR Times Fill Time : xxxmins

		Stir Time : xxxmins Drain Time : xxxmins
	SETUP IRR Mode/Tank	SETUP IRR Mode/Tank Irrig Mode : Mode1 Dose while Fill : Y TankSize : xxxxxltrs
SETUP Dosing	SETUP DOSE pH Mode	SETUP DOSE pH Mode pH Mode : pH Raise
	SETUP DOSE DoseTimes	SETUP DOSE DoseTimes EC DoseTime: xxx sec pH DoseTime: xxx sec Dose Intrvl: xx.xmin
SETUP Modifiers	SETUP MOD Inside	SETUP MOD Inside RH Weighting : xx Temp Weighting : xx
	SETUP MOD Outside	SETUP MOD Outside RH Weighting : xx Temp Weighting : xx Wind Weighting : xx
SETUP Temperature	SETUP Temperature Temp SP : xxx.x°C (xxxxing)	
SETUP Mister	SETUP Mist Mode	SETUP Mist Mode Mist Mode: xxxxx
	SETUP Mist En/Trig	SETUP Mist En/Trig Mist Enabled : Y Mist MinTemp : xxx.x Trigger : xxx.xx Mol
	SETUP Mister Times	SETUP Mister Times Active Time : xx:xx Pulse ONTime: xxxsec Pulse OFFTime:xx:xx

SETUP Peripherals	SETUP Peripherals Enviro : WS : Autovent 2/3 : Flow Module :	
SETUP Address & Log	SETUP Adr & Log Time Address : Log Time : xx:xx m:s	
SETUP Outputs	SETUP OUT Installed	SETUP OUT Installed O1 : Y O2 : Y O3 : Y O4 : Y
	SETUP OUT Function	SETUP OUT Function M1 B=xxx% M2 B=xxx% O1 : EC O2 : EC O3 : pH O4 : BULK
SETUP Meters	SETUP FLOW Installed	SETUP FLOW Installd Main Meter : Y Flow1 : Y Flow2 : Y Flow3 : Y Flow4 : Y
	SETUP FLOW Main	SETUP FLOW Main Mtr xxx Pulses/100L
	SETUP FLOW Fert	SETUP FLOW Fert Mtrs (Pulses / 10L) F1 : xxx F2 : xxx F3 : xxx F4 : xxx
SETUP Rain Effect	SETUP Rain Effect Reset Outside Solar Int when Rain > xxxmm in xxxhrs	
SETUP Factory Dflts	SET Factory Defaults (!! ALL SETTINGS !!) Press Enter to Reset to Factory Defaults	SET Factory Defaults Reset To DEFAULTS ARE YOU SURE? Enter = Y Exit = N

5 Installation of controller and sample pot

IMPORTANT:
1) Check that the NutriDose is correctly rated for your power supply voltage
2) The NutriDose must be installed (and stored) in a shaded, cool, dry, well ventilated position. This may be inside a greenhouse which is fully controlled so that the relative humidity does not regularly exceed 90%. For uncontrolled greenhouses, propagation houses, or other high humidity situations it must be installed in a plant room next to the greenhouse which itself is cool, dry, shaded from direct sun and well ventilated. It must never be left in full sunlight or in very hot conditions such as in an automobile. If installed within a greenhouse this normally means that a special shade/drip cover must be provided and shown below. This is important as the surface temperatures of items in a greenhouse in summer, in full sun, may easily exceed 60 deg C (140 deg F). If this is allowed to happen the warranty is voided.

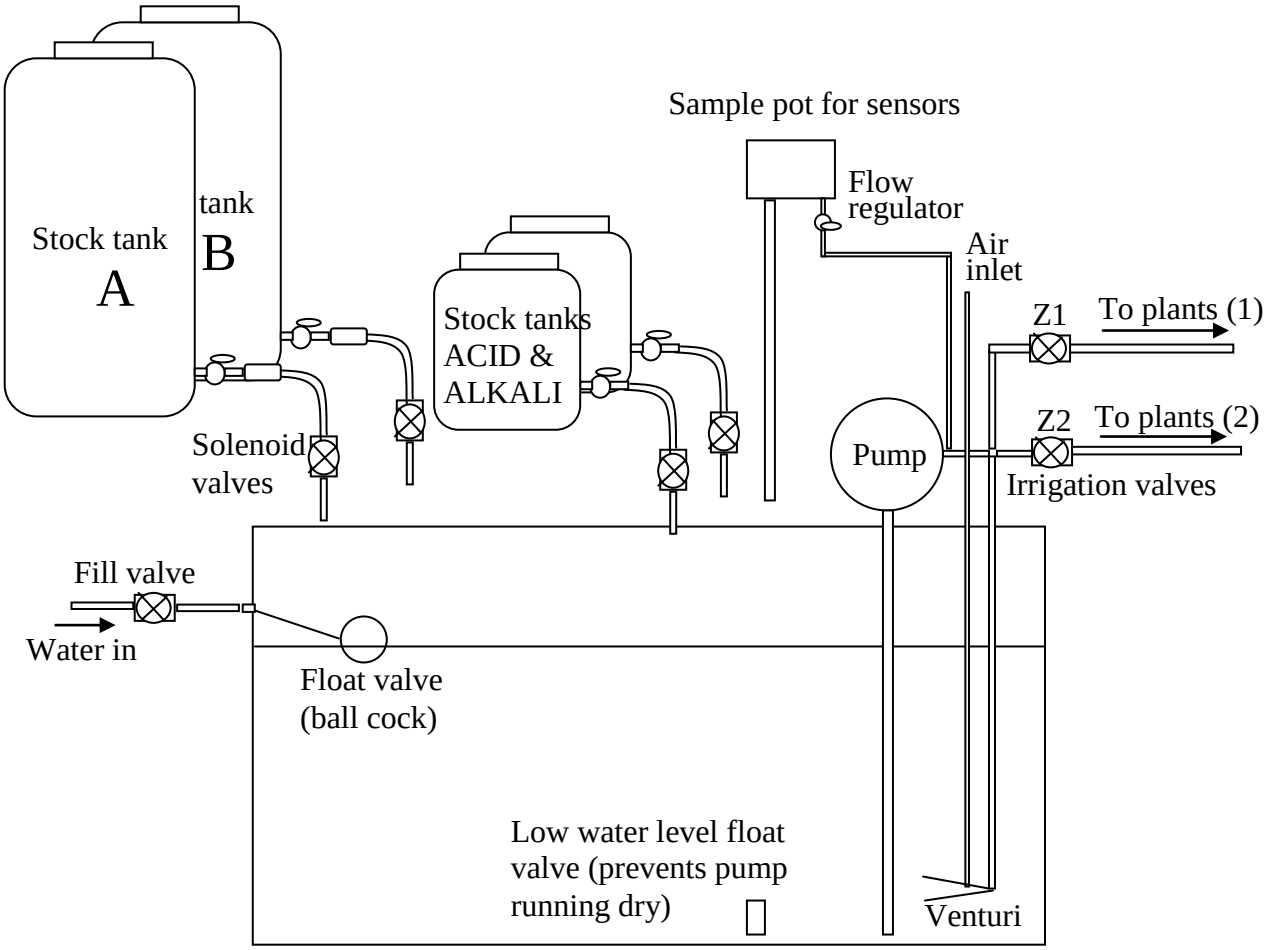


Install NutriDose in shaded position protected from moisture. Mount on a board made from material such as thick ply-wood that is not a good conductor of heat

Position the sample pot within close reach of the controller but not where the controller is liable to get splashed if the sample pot overflows etc. Ensure that the leads to the sensors will easily reach between the controller and the sample point.

5.2 Dosing sub-system

Dosing can be done in a number of ways. Where the main tank is underground a simple gravity feed system using solenoid valves may be used. Having the main reservoir tank below ground level has a number of additional advantages such as helping to keep the nutrient water cool during summer as well as saving floor space. In this example, it is assumed that water is supplied under pressure from either the town water supply or from a pressure activated pump which supplies water from a bore (well) or from a storeage tank.
It is good practice to either limit the size of the stock tanks or else provide smaller "day" tanks. This is to limit any effect on the plants if all of the stock solution was dumped into the tank due to an equipment failure or incorrect setting. The small day tanks are filled from the larger stock tanks every morning. This can be automated by using small pumps that are operated from a time switch. This also ensures that the stock tanks get stirred every day which will help to avoid stratification of the nutrient in the stock tank.



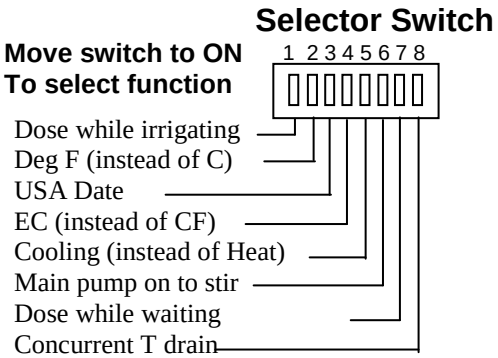
Simple gravity-feed dosing system for two-zone batched irrigation

To ensure an equal dose from the A and B stock tanks it is important that both filters are clean and that the pipes are of equal length and are not kinked or otherwise restricted. To achieve equal dose sizes it is also important to position both A and B tanks and also the solenoid valves or pumps at the same height.

In situations where the main tank is not below ground level, or if preferred, peristaltic pumps may be used to deliver the nutrient from the stock tanks or day tanks up into main reservoir tank. Many growers prefer the pump option as there is slightly less chance of overdosing in the event of a solenoid becoming jammed open. However, with good quality solenoid valves and regular maintenance this should never happen.

Note also, that during dosing, the pump must keep the nutrient solution flowing through the sample pot and the nutrient water in the main tank must be thoroughly mixed. This can be done by running the main pump as shown in the diagram. Note the use of a venturi to aerate and stir the main tank. This is highly recommended.

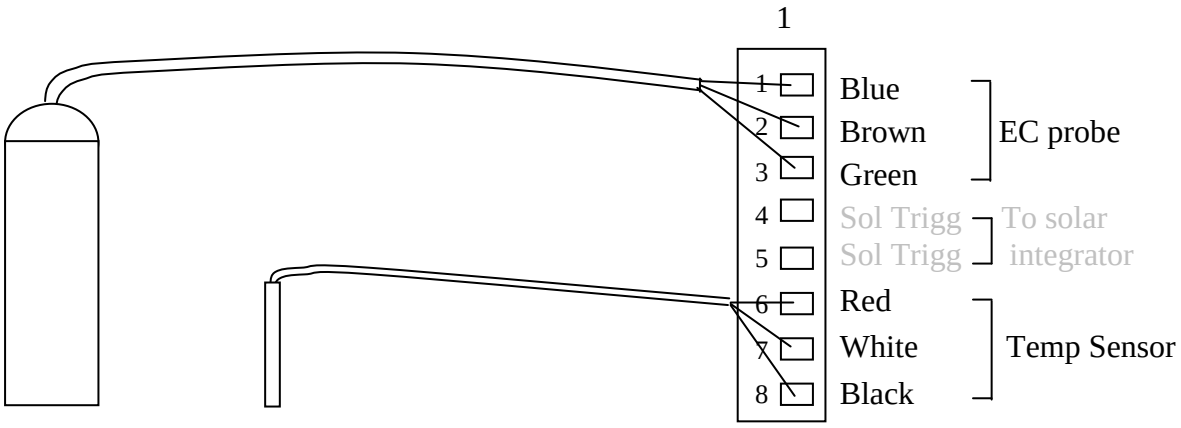
5.3 Set selector switch (located under side cover)



Set switches suit you preferences.
If you are cooling instead of heating then move switch 5 to the ON position. Switch 6 controls whether the main pump runs during the stir/dose cycle. If you are using the T drain function to drain your T tapes and you want the next irrigation to commence whilst still draining the previous drip tape then move switch 8 to the ON position.

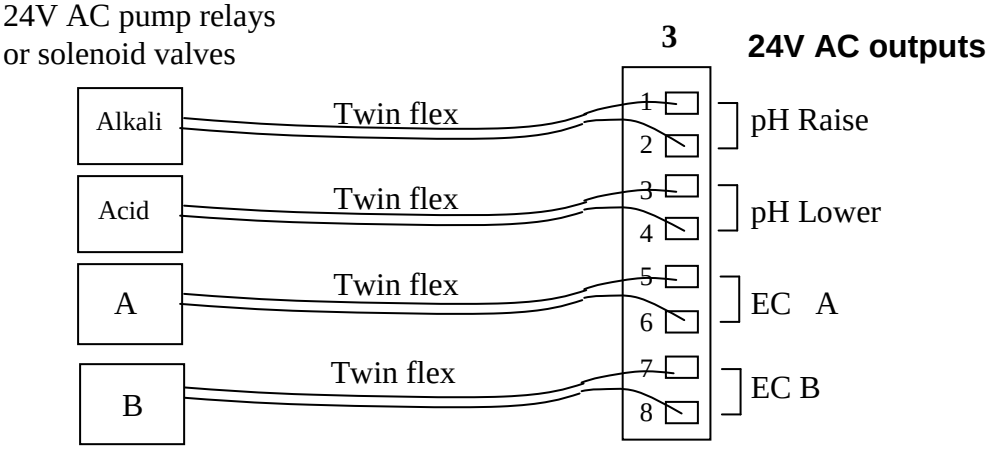
5.4 Connect the EC probe, pH electrode and temperature sensor

The pH electrode simply connects to the BNC connector on the front panel. The EC probe and temperature sensor are connected to connector 1 (the leftmost connector) which is located under the cover on the right hand side of the controller.



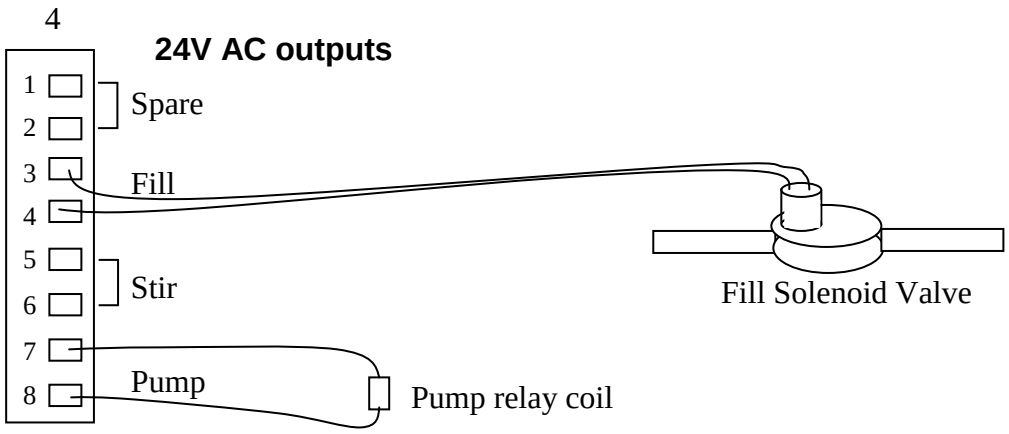
Connection of EC probe and temperature sensor

5.5 Install and connect the dosing solenoids or pumps



5.6 Fill solenoid valve installation

The fill solenoid valve is installed in series with the float valve of the reservoir tank. The Float valve should be a "full flow" type to allow rapid filling of the tank between irrigations. The fill solenoid valve is connected to connector 4 as shown below.



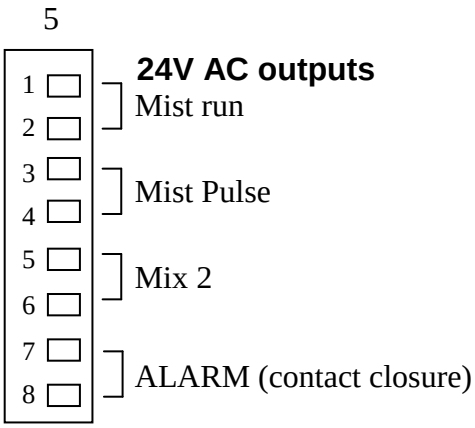
5.7 Pump relay installation

The irrigation pump will be mains powered and so you will need to have a power relay fitted by an electrician to supply power to the pump. This relay should have a 24V AC coil which should be connected to connections 7 and 8 of connector 4. (see diagram above). A low-level switch may be connected in series with the coil to stop the pump running when the water in the tank is too low.

It is usual to use the main pump to also stir the tank during dosing. To do this, switch ON the selector switch number 6 and use thin pipe to feed back from the output of the pump through the venturi into the tank. By using thinner pipe, enough pressure will be left to allow irrigation of each zone when the irrigation starts and the zone valves open. If an undersized pump is used then it may be necessary to install a solenoid valve between the pump output and the venturi. This solenoid would be connected to the "stir" output ie connections 5 and 6 of connector 4 (see above). This allows water from the pump to return to the tank via the venturi only during the "stir and dose" cycle and not during the irrigation cycle.

5.8 Zone solenoid valves

The zone solenoid valves should also have 24V AC coils. These are connected directly to the Zone 1 and Zone 2 outputs on connector 5



5.9 Heater (or cooler) connection

The heater output may be used to operate a nutrient or grow-bed heater. If used for grow-bed heating then the temperature sensor must be placed in the grow-bed whilst for nutrient heating it is normally placed at the bottom of the mixing tank. For continuously recirculating systems it is normally placed in the sample pot. The lead on the sensor may be extended by up to 40metres (120ft) using CAT5 cable. The connections should be made inside a sealed connection box to avoid corrosion. To operate the heater an electrician is needed to wire a mains power relay with a 24V AC coil to the heater output (connections 1 and 2 on Connector 5). When using a heater ensure that selector switch 5 is OFF. For cooling, this switch should be ON.

5.10 Set up the dosing set-points.

Set the EC (sunny) and EC (cloudy) setpoints and set the maximum rate of change that you will allow the controller to make. Normally this will be set to be quite slow. You do not want the EC to change every time a cloud comes past. Set the pH set point and also specify if pH lower or pH raise is required. Then set the dose times for both EC and pH. The dose time should be sufficient to cause a change in EC (after mixing) of 0.1 to 0.2 mS/cm (1 to 2 CF) and a change in pH of 0.2pH after mixing. The dose interval should be set to a sufficient time for each dose to mix with the water in the tank. If the dose sizes are too small, or if the dose interval is too large, it will take a long time to dose the tank up.

When first installed and set-up it is always a good idea to first fill the stock tanks (A& B fertilizer, acid and alkali) with plain water and observe the dosing operation for a while. This will also give you an opportunity to test for leaks.
Test the dosing outputs by forcing them on and off from the or from the controller. Also watch them occur automatically.

When everything has been thoroughly checked, fill the A & B drums with the fertiliser mix as directed and stir thoroughly until fully dissolved. In larger systems it is common to use small pumps to circulate and stir the stock tanks to mix them thoroughly. Next fill the acid and alkali tanks as follows:- First add the water to each tank and then add acid and alkali to the water to achieve a concentration of about 2%; stir the mixture as the heavy acid will sink to the bottom. Note that if strong acid/alkali is dosed into the nutrient solution it can cause a localized chemical reaction, which will gradually cause the composition of the nutrient to change.

5.11 Sensor Calibration

When calibrating it is a good idea to disable dosing first but remember to re-enable it when you have finished. To disable it press the mode key to get to the “Overrides” menu item, press enter (up arrow) to enter this sub-menu. The first menu item is dose enable so press the down arrow to set this OFF and then press save.

Calibrate pH

Connect the pH electrode to the BNC plug connector on the front of the unit. Place the electrode in the pH 7 buffer solution and allow it to stand for 10 minutes. Now press the mode button to get to the “calibrate” menu item. Press enter (the up arrow) briefly to enter the calibrate sub-menu. Now press the up or down arrows until the reading is exactly 7.00pH. Press save.

Rinse the electrode in water, then place in pH 4 buffer solution. Wait for 10 minutes and then press the mode button to get to "calibrate" on the menu. Now briefly press enter (up arrow) to enter the submenu and **now press the Mode button again to get to cal pH 4**. Now, press the up and down buttons to get the reading to be exactly 4.00pH and press save. Recheck by placing the pH electrode back into the pH 7 buffer.

Calibrate EC
Clean the face of the EC probe using a clean nylon kitchen scourer such as a "ScotchBrite" together with a mild abrasive cleaner such as "Jif", rinse in water and place in the EC standard solution. Allow a ten minutes for the temperature compensation to take effect. Now move down to "calibrate", press enter and then press the mode key again to get to the CAL EC (CF) mode. Now press the up and/or down arrows to get the reading to be exactly the same as the value of the standard solution (usually 27.7 CF or 2.77 EC). Press save.
Note: For highest accuracy, use a standard solution which is as close as possible to your working value and renew the standard solution at regular intervals (3 monthly) .

Remember to re-enable dosing when you have finished calibration.

5.12 Connection to AutoVent, EnviroSensor or solar integrator
The NutriDose II can obtain solar and environmental information for its solar integrator from a number of sources. We will deal with each in turn

AutoVent II or III
Connect the Cat 5 COMMS cable from the AutoVent to COMMS B port on connector 6, pins 3,4 and 5. In SETUP choose PERIPHERALS and select AutoVent 2/3.

EnviroSensor ES or Enviro Minder (TRS2000)
If using the EnviroSensor for the solar integration function then connect a CAT5 communication cable from the ES COMMs connection to COMM A port on connector 6 (pins 6,7 and 8).

If more than one Enviro sensor is used then loop the CAT5 cable from sensor to sensor. Then set the addresses of each unit by fitting jumpers on the circuit board as follows:-

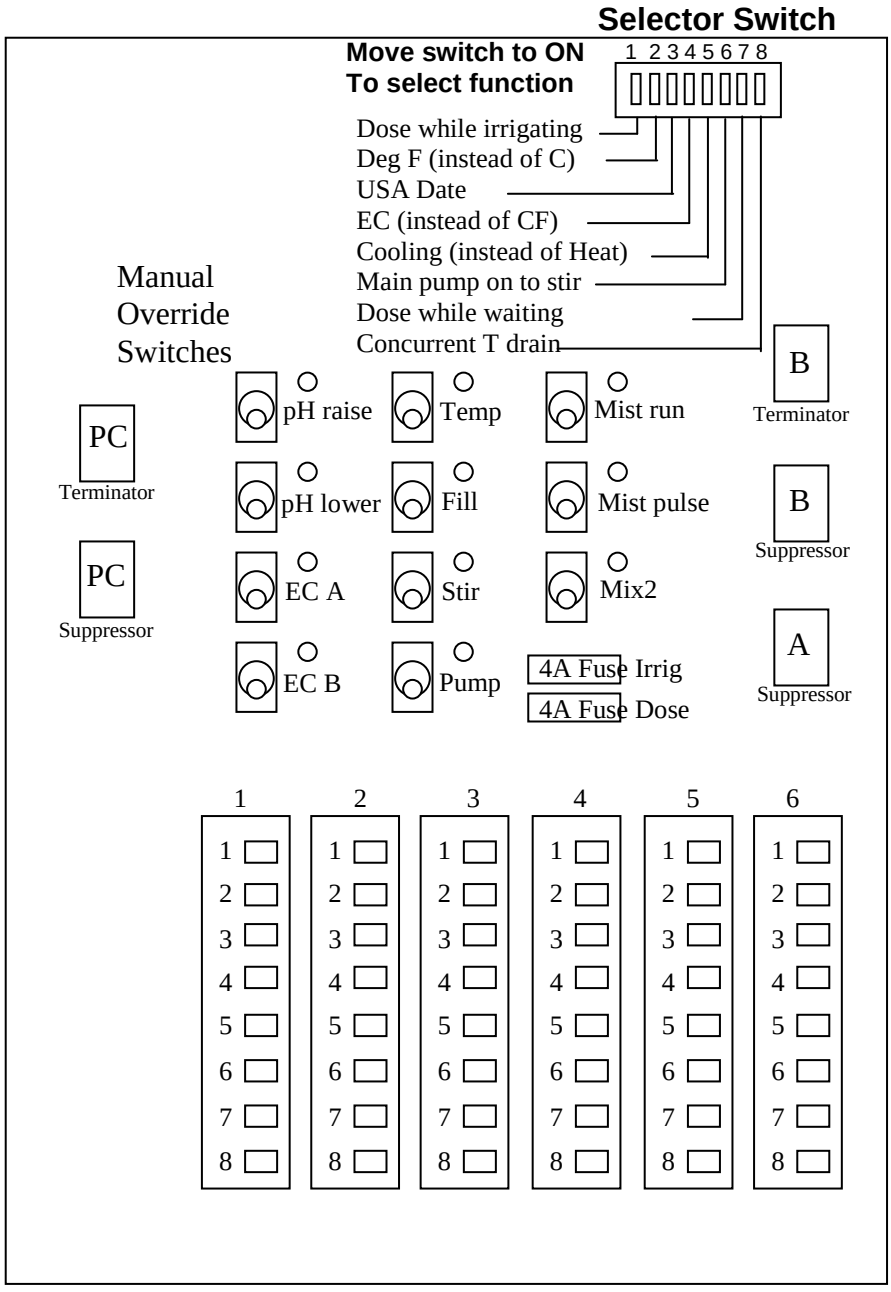
First unit	no jumpers
Second unit	jumper installed at position B
Third unit	jumper installed at position C
Fourth unit	jumper installed at position D

In SETUP choose PERIPHERALS and select ENVIRO as the source of the solar integration.
.

6 Connection diagrams

IMPORTANT:- Before connecting the controller to the mains power supply, check that the voltage sticker on the side of the case matches the voltage for your mains power. This will either be 100-120V or 200-240V.

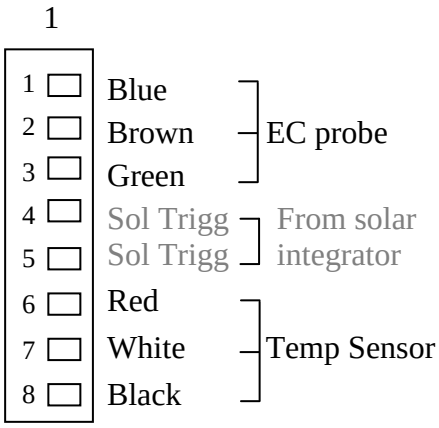
6.1 Main Circuit Board

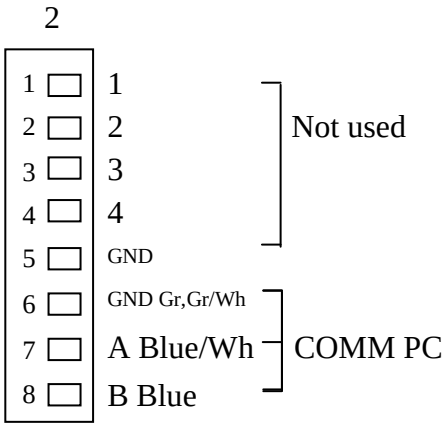


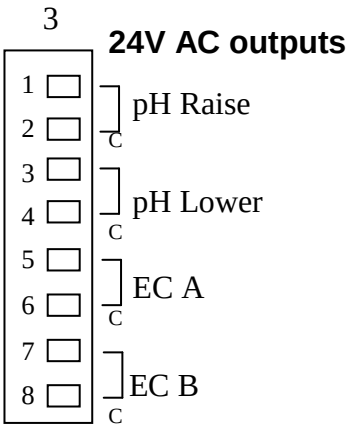
Note that only low voltages (not mains) can be connected to these contacts.

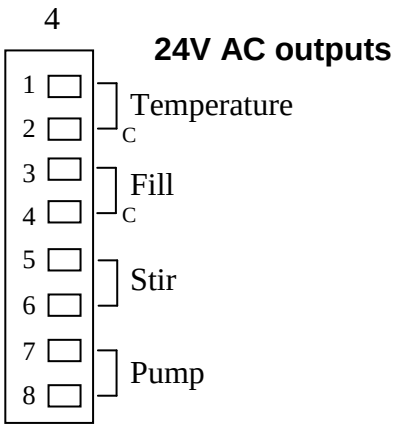
The manual override switches have three positions:-
DOWN=Automatic; CENTRE = OFF; UP = ON

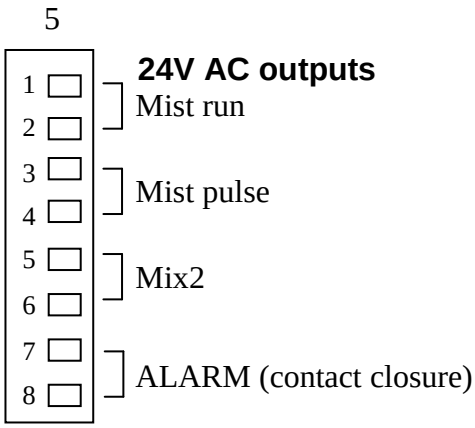
6.2 Connectors

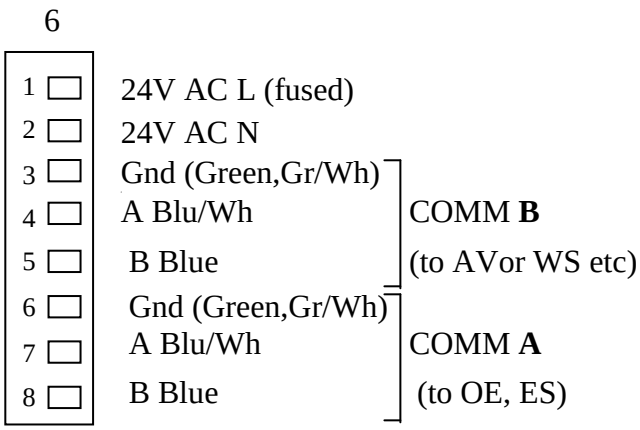






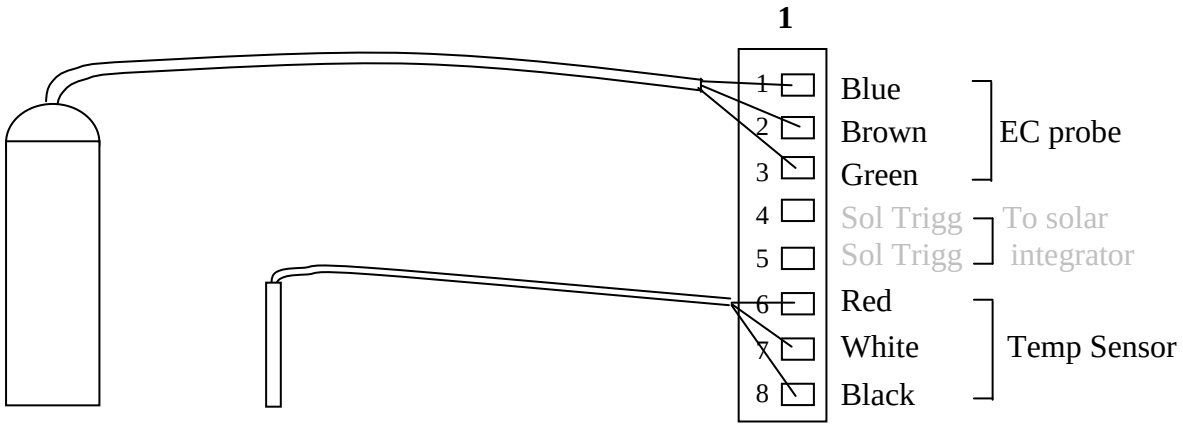






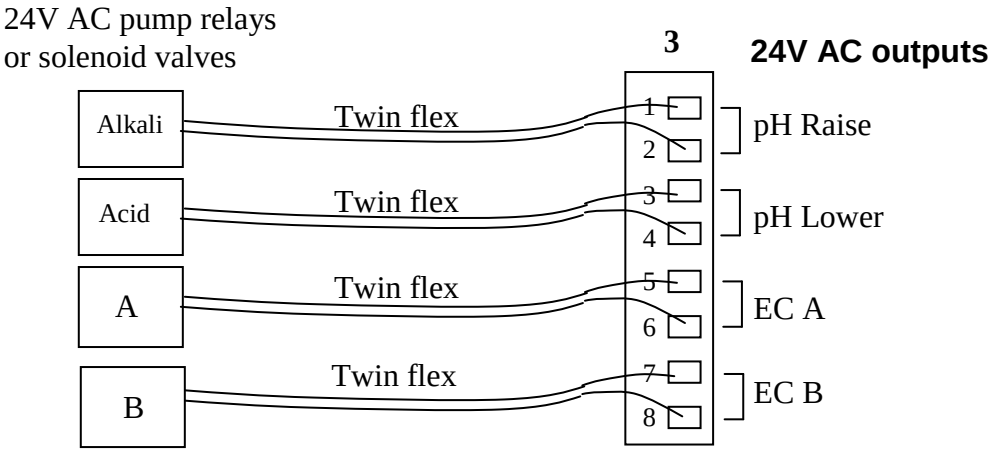
NB: On CON6 only connect to WS or ES if there is no AV to connect to and you require outside (WS) or inside (ES) irrigation by solar triggering. The lower pin of each pair is the common.

6.3 Connection of Sensors



Connection of EC probe and temperature sensor

6.4 Connection of Dosing solenoids or peristaltic pumps



Connection of dosing pump relays or solenoid valves

Where the main tank is above ground, dosing pumps may be used to dose the A & B nutrients and pH adjusters. If mains powered pumps are used, relays must be used to re-power the 24V AC outputs from the NutriDose.
The peristaltic pump unit supplied by Autogrow System is designed to connect directly to these outputs without any additional relays.

Configuration of Zone expansion unit

The ten station zone expander units have dip switches that need to be set as follows:-

First unit (stations 1 to 10)	set all switches to OFF
Second unit (stations 11 to 20)	set switch 1 ON and switches 2,3 and 4 OFF
Third unit (stations 21 to 30)	set switch 2 ON and switches 1,3,4 OFF

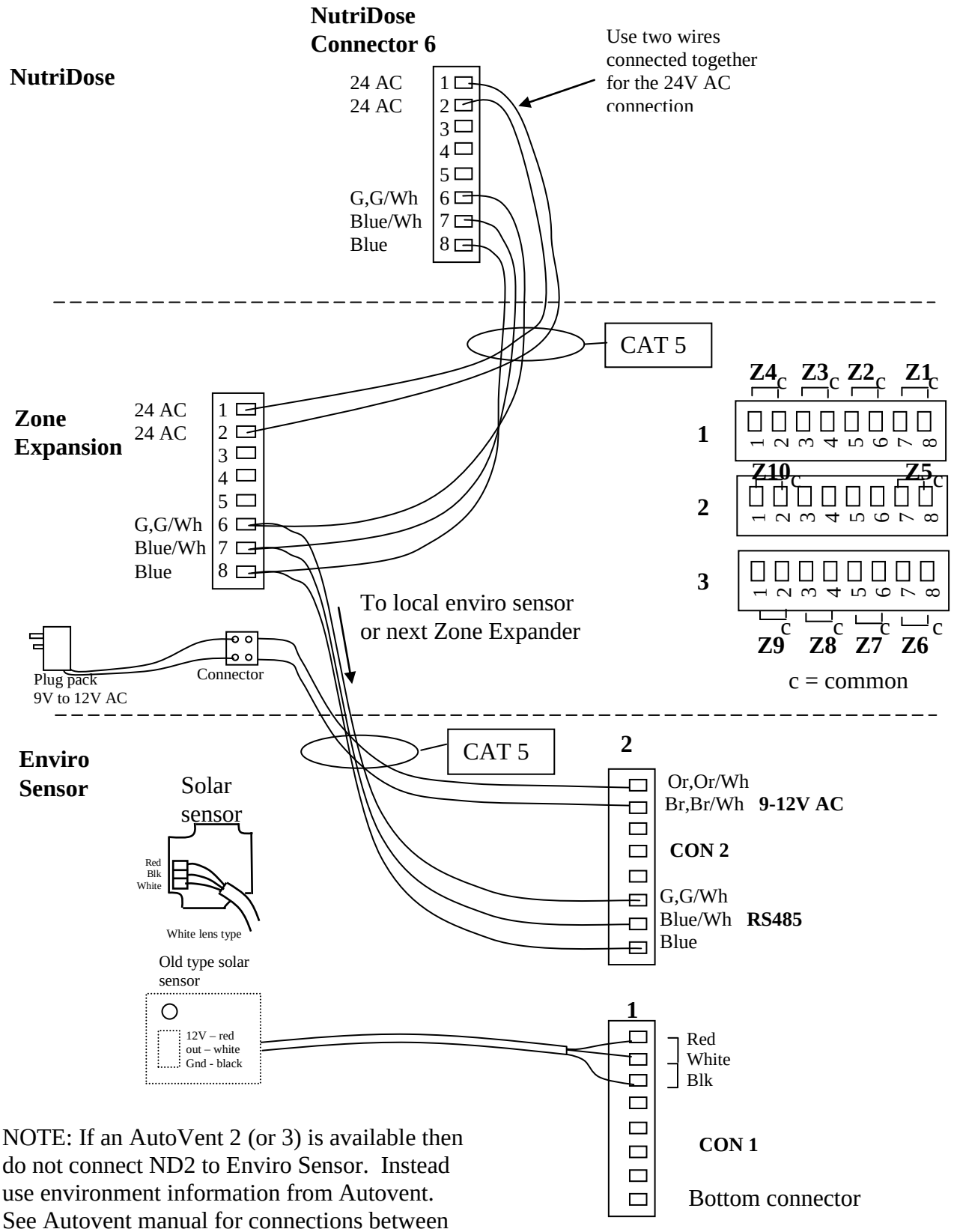
At the connections to the zone expander not that all Common connections are internally connected together and you may run a single common cable to feed a group of station solenoid valves. This common cable can be connected to any connector marked with a "C".

Configuration of Enviro sensors

These are configured in a similar way to the zone expanders except that instead of a dip switch, jumpers are used to short pins together as follows:

First unit	no jumpers
Second unit	jumper installed at position B
Third unit	jumper installed at position C
Fourth unit	jumper installed at position D

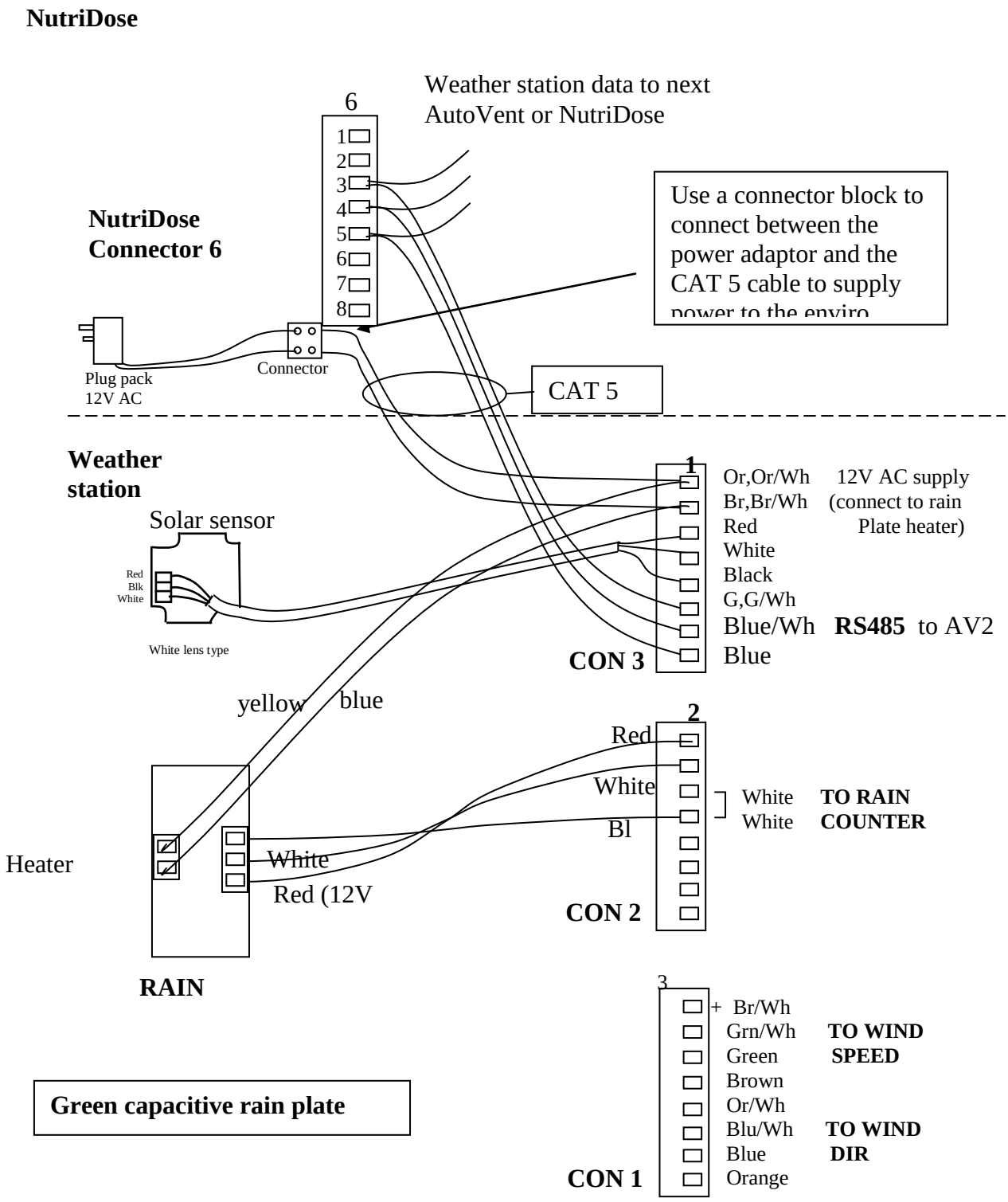
6.5 Connections from NutriDose to Peripherals



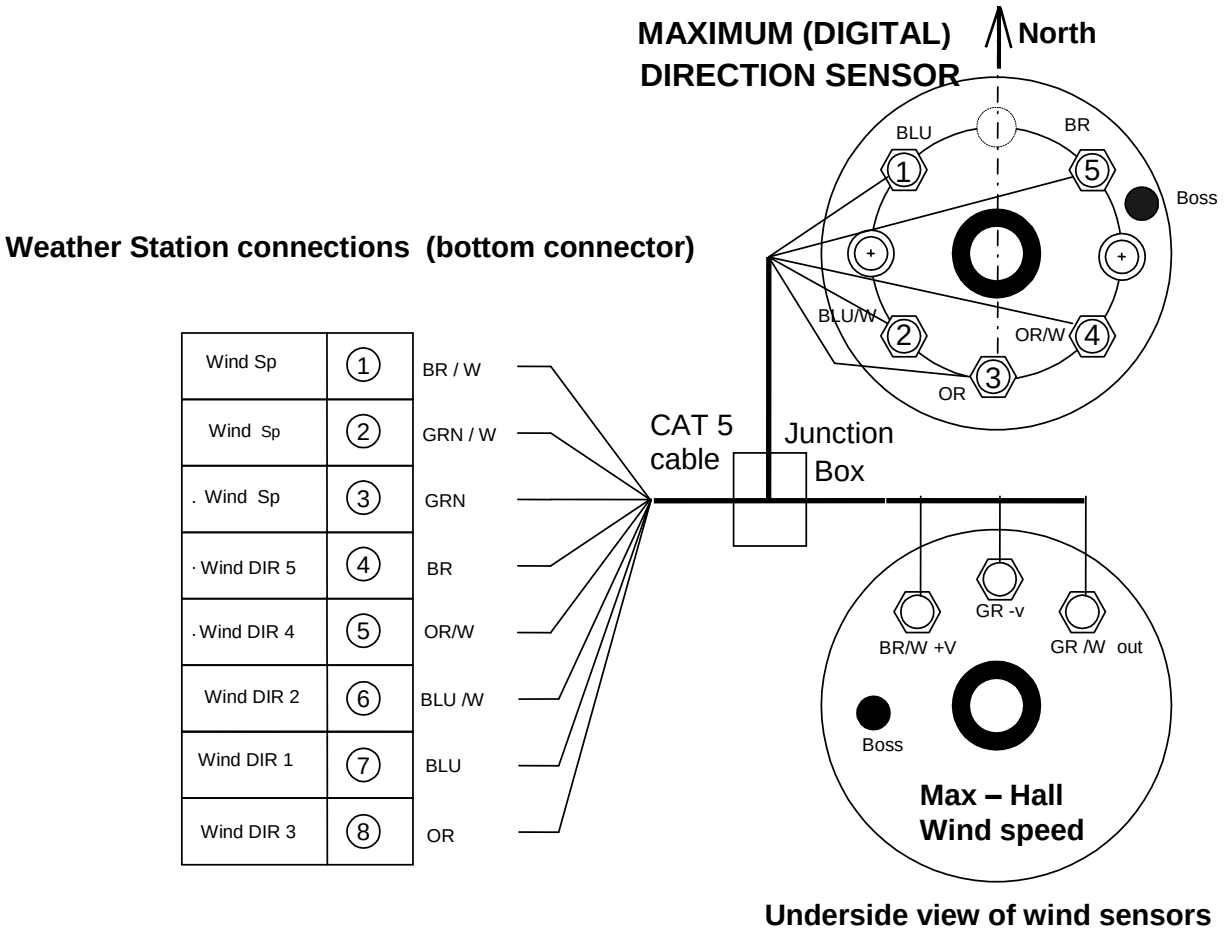
NOTE: If an AutoVent 2 (or 3) is available then do not connect ND2 to Enviro Sensor. Instead use environment information from Autovent. See Autovent manual for connections between AutoVent and NutriDose

Weather Station connections

The Weather Station broadcasts a report of the weather every three seconds to as many AutoVent and/or NutriDose controllers that you have connected (maximum 128). The connecting bus (CAT 5 stranded cable) loops from one controller to the next. Only the two devices at the extreme ends of the cable should have their terminating modules installed. All intermediate devices must have their terminators removed. Note that the order of connection is not important and the diagram below shows only one possible ordering.

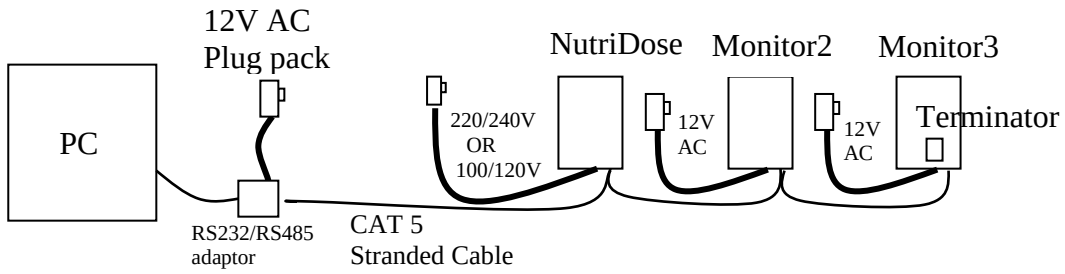


Connection of Wind Sensors to Weather Station

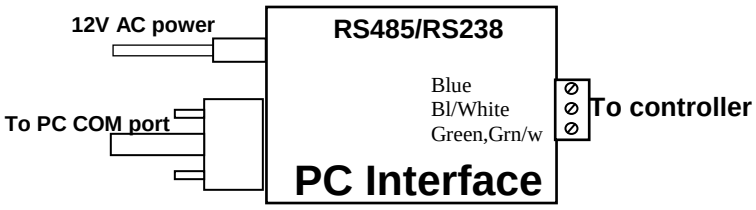


6.6 Data communication cable

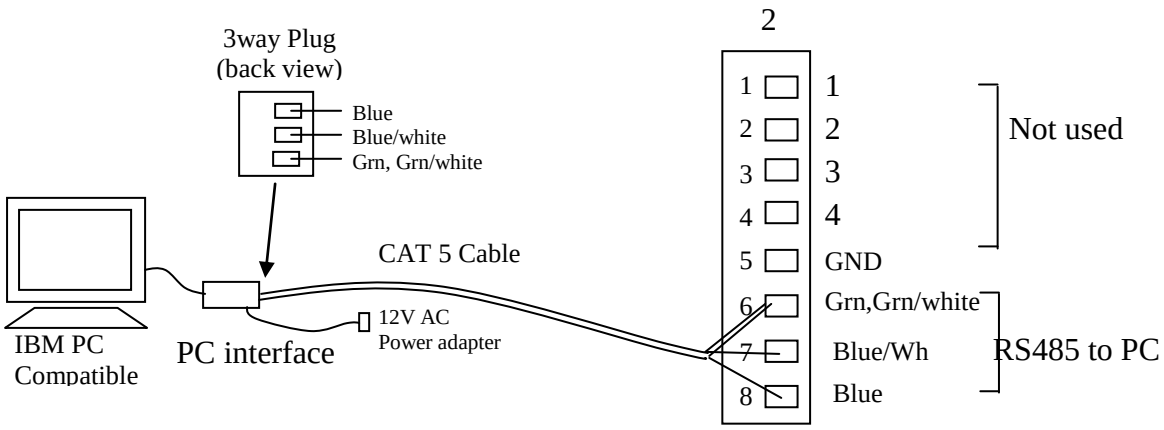
Use light coloured (so as not to attract heat) CAT5 stranded computer network cable between the PC interface and the NutriDose and/or monitors. This cable is "looped in" to each controller/monitor in a "daisy chain" fashion. The last monitor (and only the last monitor) in the chain must have a "terminator" fitted. Remember, when adding a further controller/monitor to remove the terminators from any monitor between the PC interface and the last monitor in the chain. See connection diagram below.



PC connection showing a single terminator at the end of the cable



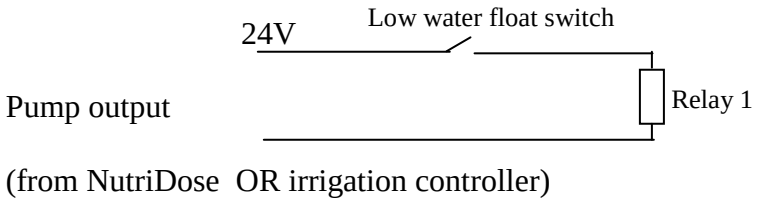
PC interface connections

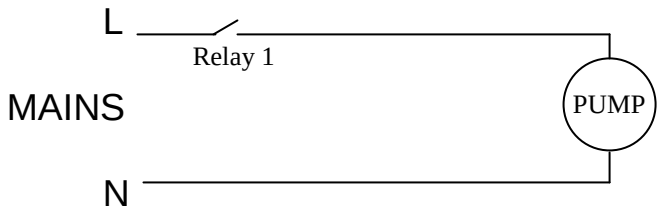


Connection of PC interface to the controller

6.7 Connection to the main pump

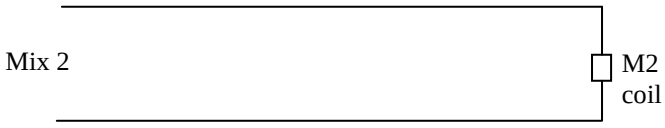
As the outputs from the NutriDose are 24V AC they need to be connected to external relay whose contacts will switch the mains power to the pump as follows. **An electrician should be employed to do this work to ensure that it complies with local codes.**

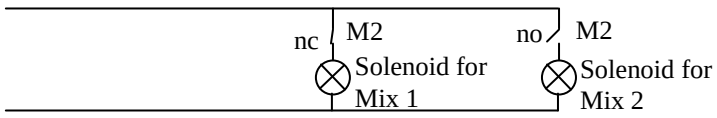




Note the use of a float switch to prevent the pump from running when the water is too low. If this is not fitted the pump could suffer damage if the water runs dry.

6.8 Connection for mix 2 selection



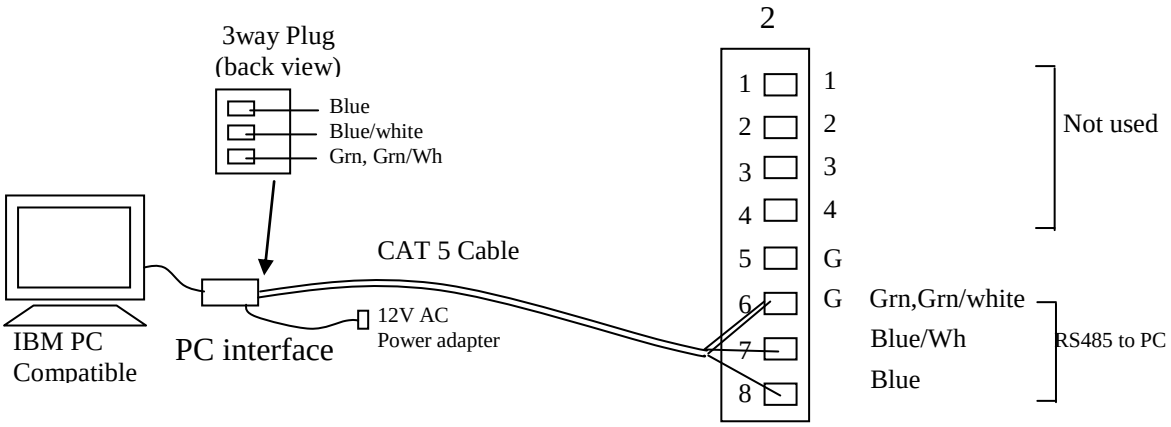


Relay for mix 1 – mix 2 nutrient selection

7 Installation of the PC interface

7.1 The PC Interface.

The RS484/RS232 optically isolated interface box should be installed adjacent to the PC computer. It requires a 12V AC supply. A lead is supplied to connect this to a free DB9 COM port on the back of the PC. A CAT 5 cable (computer network cable) should be used to connect between the PC interface and the controller as shown in the diagram.



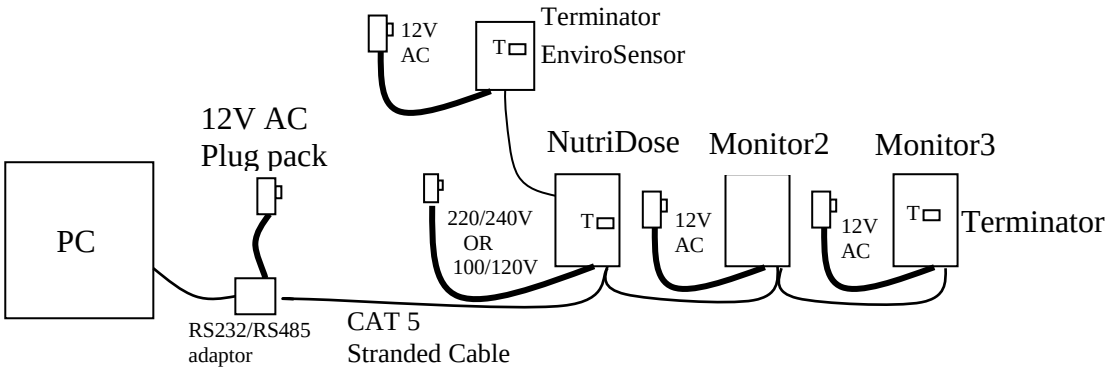
Connection of PC interface to the controller

7.2 Communication addresses.

When the PC requests data from a controller or monitor it first sends the address for that unit. All units connected to the PC must have a different address. The base address for these controllers is 34. At the controller, press the mode key to get to SYSTEM and press enter. Here you will find the "address" number. Press the up or down arrows to change the address to a number that is different to all other units connected to the PC. Typically, set the first controller to 34, the next to 35 and so on. After setting the address, press save to store it in permanent memory. Make a note of the address of each controller/monitor and its type (eg TRS, NutriDoseII etc as you will need to enter this information on the PC.

7.3 Terminator.

The CAT 5, RS485, data cable starts at the PC interface and loops in and out of ALL devices until it reaches the furthest unit. Inside all controllers and monitors will be found a terminator plug. This is a very small circuit board with a small resistor and capacitor on it. These terminators must be removed from all units except for the one at the end of the cable. To locate the terminator, refer to the diagram of the main circuit board in section 5.1.



PC connection showing a single terminator at the end of the cable

Note that the secondary cable from the NutriDose to the EnviroSensor also requires a terminator at both ends.

7.4 Installation of the Compugrow software

The CompuGrow software is suitable for use on a PC compatible computer running Windows 95/98/2000/XP. The computer must have a free serial COM port and should be a Pentium or better.

To install the software on your PC, insert the disk in drive A and execute the CompuGrow self-installing program. You will be prompted during installation to select a folder. The default folder is C:\Program Files\ Compugro\... When the program is executed it will create some sub-folders under this folder. Each system (greenhouse) installed will have its own sub-folder where the log files for each of its monitors and controllers is stored. Each file will save the data for the whole current month and the name of the file contains the date (year and month) to make file management easy. Once installed, the program may be executed in the usual way. The first time it is run it is necessary to create a new system and then specify the type and addresses of all controllers and monitors within that system. The help function can be used on-line to assist with this task.

7.5 Configuring the PC software.

Before running the software it is best to install all the controllers and monitors. They should all have their date and time setting checked and each device must have its address set to a unique number. Remember to save the addresses after making any changes and make a note of them as you will need to have them when installing the PC software.

Now, at the PC, run the compugrow.exe application and then set up as follows.
When the Compugrow software is first executed the immediate task is to select the required security access level. In order to set the system up, security must either be "disabled" or else you must select 'advanced' and enter the advanced password which is 'consult'. The basic level password is 'grower'. These are the default passwords which can be changed to anything you desire when in advanced mode. Alternatively, from advanced mode you can disable security by selecting setup/security/disable.
Next, select the serial COM port that the RS232/RS485 adaptor is connected to. (Note that the adaptor must be one supplied by Autogrow as it performs some special functions as well as converting the signal levels and providing optical isolation.)

Under "setup" select "add" to add a new system then give the system a name (usually the name of the greenhouse eg lettuce 1) also check the controller box and monitor box if you also have any monitors in the system.

The idea of having different "systems" is that in a large installation where you might have a number of controllers and/or monitors in each greenhouse, it allows you to collect together all of the devices from the one greenhouse as one system so that when you view them they are not muddled in with devices from the other houses. However, if you are only intending say one or two controllers per greenhouse then it is probably more convenient to put all devices into one system.

Once a system has been added, select setup/system setup/configure/<*system name*>
And for each controller and monitor, add the address (as set at the actual controller), select the type of controller, enable it and finally click on "save".
The PC will now try to communicate with the device and values should appear on the "Readings and Settings" tab. If not, try clicking on "refresh" on the main menu bar and observe the message at the bottom, right of the screen. If this says "offline" then the communication link has failed and you will need to recheck that everything is wired correctly and switched on etc. Also recheck all settings. If still not working refer to the fault finding section.

Finally set the logging frequency to be every 5 minutes. The software creates one file for each monitor or controller for each month. Obviously a logging frequency of one minute will create much larger files than if set to 5 minutes and should only be used when you really require that level of detail.

8. Maintenance

Every two weeks:-

Thoroughly clean the EC probe.

Remove the shroud (if fitted), scour the face with a mild bathroom abrasive like Jif (NOT Lemon JIF as this contains oils) on an abrasive nylon pad (ScotchBrite) and then rinse in clean water. DO NOT TOUCH THE PROBE FACE as your perspiration may contain oil.

Replace the shroud fully (so that the face of the probe is central in the round side windows)

Shake off all excess water and place in the CF 27.7 (EC 2.77) standard solution. Allow to stand for ten minutes before calibrating. The up/down buttons may need to be pressed a number of times (or held down for a while to invoke auto-repeat) to make the displayed values change to the correct reading. Press *save* to store the new calibration.

Check the calibration of the pH electrode:

First rinse in fresh water. Shake gently to displace excess water and place in pH 7 buffer solution. Stand for 10 minutes or longer. Select CAL pH7 mode. Now press the up/down buttons to get the display to read 7.00 and then press **save**. Rinse the electrode in fresh water, shake excess water off and place in pH 4 buffer. Stand for ten minutes or more and then select CAL pH4 mode. Now press the up/down buttons to get the display to read 4.00. Press **save.**

pH electrodes are only warranted for six months but should last for between six months and three years. Never let the tip dry out and when not in use stand in clean water which has a little pH4 buffer added. As pH electrodes age they tend to get slower and slower and also drift when in weak solutions (ie in the nutrient solution)

If the pH electrode is looking particularly dirty, you can try standing it in 20% acid for 10 minutes. This will sometimes rejuvenate an aging electrode

The temperature sensor is guaranteed by the manufacturer (Dallas semiconductors) to be accurate to within 0.5 deg C and so any adjustment should be very small. Only calibrate this if you have a **very** accurate reference thermometer. (We have found most sensors to be accurate to within 0.2deg C without any calibration)

9. Faultfinding

Before looking for a fault, ensure all settings (both switches and keypad) are correct

No display : Check power supply is ON and also check fuse on side of cabinet. For the 220V-240V version a 1 Amp fuse is fitted; whereas a 2 Amp fuse is supplied for the 110V-120V model.
EC reading incorrect: **Clean the EC probe** and ensure no air bubbles are trapped beneath it then recalibrate
pH reading wandering and won't calibrate: pH electrode may need to be replaced
No dosing – check dosing fuse
No irrigation outputs – check irrig fuse
No PC communications – PC reports controller to be offline

- address at monitor different to address at PC or two controllers/monitors set with the same address
- cable between monitor and PC broken – try moving the monitor close to the PC to exclude the long cable
- Wires in cable between monitor and PC crossed
- Terminator missing from furthest monitor or terminator present on intermediate monitor. (Only one terminator should be in the system at the furthest monitor from the PC)
- No power to the PC interface unit
- Cable between PC and interface unit disconnected or in wrong COM port of PC
- PC configuration incorrect (IRQ clash or port not installed)
- Wrong COM port selected within CompuGrow software
- Invalid date being received from controller. Reset the time and date and then clear all logs as follows:-
  (a) Switch off power
  (b) Hold both mode and save keys pressed in
  (c) Switch on power and then release the keys

Uploaded data cannot be viewed in the history screen

- Date and/or time on controller or PC incorrect – set time/date and clear logs as described above

Upload of logged data does not stop.

- Clear the logs as described above

10. Warranty

The warranty on the controller, EC sensor and temperature sensor is limited to 2 years – return to factory. Before returning the unit for service you must call Autogrow Systems Ltd for a return authorisation .
pH electrodes, RH sensors and fans carry only a 6 month warranty from their respective manufacturers.
This warranty specifically excludes any parts that have been broken or damaged by water, chemical attack or excessive temperature. In particular, the controller and PC interface must be stored and used in a dry, shaded and well ventilated situation. At no time must the case temperature be allowed to exceed 60 deg C (140 deg F).

This warranty specifically excludes liability for consequential damages or for charges for labour or other expense in making repairs or adjustments, or loss of time or inconvenience.

11 Glossary of Terms and abbreviations

NFT - Nutrient film technique – Nutrient rich water is continuously circulated as a thin film along the bottom of "gullies". The plant roots spread as a mat over the floor of the gully and absorb nutrient. Often used for growing lettuce and tomatoes

DFT – Deep flow technique - Nutrient rich water is circulated (either continuously or intermittently) through gullies. The water is usually about 60mm deep and in warm climates the gullies are completely insulated by expanded polystyrene sheet material. In many cases the plants are supported in holes through floating polystyrene boards

Flood-and-Drain. In this method the plants are placed in media (usually in pots) on a raised platform or table that is easily drained. The table, which has raised sides, is periodically flooded by a control system. As soon as the desired depth of water is reached, the table is immediately allowed to drain.

Fertigation – An irrigation system that supplies all of the plants food requirements along with the water

Batched Irrigation/Fertigation – In this system a tank (the batch tank) is filled with water and then dosed with fertiliser and pH corrector before being pumped to irrigate the crop

EC – Electrical conductivity measured in mS/cm (milliSiemens per centimetre)
CF – Conductivity Factor. This is similar to EC but the units are smaller so that 1 CF = 0.1mS/cm
PH - The measure of the acidity or alkalinity of a liquid. PH 7 is neutral and most hydroponic growers use a pH of 5.8 which is slightly acidic. If the pH is incorrect some of the fertiliser elements will not be available to the plants.

Solenoid valve – A water control valve that can be switched on and off by an electric current. The solenoid valve has a magnetic solenoid coil whose voltage rating must match the voltage supplied. For irrigation it is common to use 24V AC coils

On-demand dosing or Dosing – The process by which the total salts content and pH of the irrigation water is measured and then automatically corrected by a control system. As the plants use up the fertiliser, the controller automatically adds more.

RS485 – An industrial communications bus (data cable) for transferring information by low cost twisted pair cable (CAT 5 cable) over long distances up to 1.2Km

RS232 – A communications bus (data cable) used on PCs for connecting the PC to a modem etc. Only used for very short distances

Opto Isolated – An industrial technique of passing the electrical data signals between one circuit and another using only light beams. This helps prevent voltage surges in one piece of equipment from passing to another and causing damage.