Autovent 3

Operating Manual

Computerized Environmental Control System

For greenhouses with Roof/side vents AND Fan/Pad evaporative cooling

- Four time zones to allow detailed environment profiling
- Pre-dawn heating
- Advanced venting and heating algorithms
- Energy efficient automatic switch over between venting and fan/pad with intelligent pad water control
- Humidity control
- Suits wide range of greenhouse styles
- Two levels of Shading
- Thermal blanket or Blackout cloth
- Fogging – up to 4 zones
- Lighting – two banks with 52 week schedule
- Optional CO_2 injection
- Computer connection for Data Logging and Setting

Contents

Overview

Features

- Fan/pad evaporative cooling with or without passive roof/side vents
- Automatic switch over from venting to fan/pad
- Heating – proportional or ON/OFF
- Advanced algorithm for venting and heating to give good control of temperature and humidity
- Fogging control – pulsed, up to 4 zones
- Two levels of stirring fan control
- Two levels of shade control (these may be inside or outside with wind/rain overrides)
- Thermal blanket control for energy saving or blackout cloth control for photoperiod manipulation
- Exhaust fan control (variable speed or 3 stage ON/OFF)
- Four time zones to allow detailed profiling of environment plus pre-dawn heating option
- Optional CO_2 injection
- Two levels of supplemental lighting control with 52 week schedulling
- Optional PC interface with remote setting, data logging, event logs etc

Automatic change over between passive venting and fan/pad cooling

The Autovent 3 provides the functions required to provide ventilation and cooling by means of passive, energy efficient, vents when the weather is cool with automatic switch over to the more energy demanding fan/pad evaporative cooling. In many countries this allows excellent control over temperature and humidity using energy efficient roof and/or side vents during the cooler months and summer nights with fan/pad only being used during the day time during the summer.

Venting

The Autovent 3 can control the roof and side vents on most types of greenhouse including gull-wing, saw-tooth, single roof and/or side vented
The venting algorithm will try to control both temperature AND relative humidity. If heating is available then this will also be used to try to control humidity.
The roof venting uses an intelligent algorithm to adjust the nudge size taking into account present roof position, size of error, rate of error change, differential temperature (inside – outside) and wind effect. Thus, if the vents are closed and the outside temperature is low any call to open the vents will produce a very small nudge of the leeward vent. On the other hand, if the outside temperature is warm with little wind then a larger nudge open will occur.

During passive venting, fogging may be used to help with cooling and also adjust humidity. Again, if this is done it can save a lot of energy as fogging pumps are relatively small and it can avoid switching to fan/pad except when absolutely necessary.

Normally, there is a +/- 0.5^{o}C temperature differential applied to the venting so that the temperature has to be more than 0.5^{o}C above the set point for the vents to nudge open and 0.5^{o}C below to nudge closed. This however is modified by a “rate of change” function that causes the vents to operate before the setpoints are reached if there is a rapid change in temperature. Note that the rate-of-change function is also disabled during fogging to avoid the vents closing when there is a sudden temperature drop each time it fogs.

In order to avoid excessive vent operation there is a minimum delay between nudges. This is set to 3 minutes for opening operations, 3 minutes for close operations during time zones 1 and 2 (day time) and 1 minute during time zones 3 and 4 (evening and night time).

Fan and Pad

If the vents are fully open and the temperature continues to rise then the system will switch over to fan/ pad control. This will also occur if the temperature rises when the vents are disabled or restricted from opening fully due to wind or rain. The exact point at which this happens can be set by the user. Once switched to fan/pad, the system can switch back to passive venting only twice during any time zone. This is to avoid the possibility of the system constantly cycling between passive and active venting.

There are two modes of operation for the fans "normal mode" and "binary mode". Each of the three fan banks has its own set point. These are based on the time zone setpoint plus an offset for each of the fan banks. Bank 1 has zero offset and banks 2 and 3 have a user set offset applied. Typically, bank 2 will have an offset of 1 to 2^{o}C and bank 3 an offset of 2 to 4^{o}C

Normal mode

On entering the fan pad mode the system looks at the measured temperature and switches on the appropriate number of fan banks. These will start up with a 5 second delay between each group to avoid excessive loading on the electricity supply. After a further 3 minutes if the setpoint is still exceeded (by more than the 0.5^{o}C differential) then the pad water will start providing the RH is below its set point. If all fans are on then the pad water will start if the RH is below its maximum level. Once started the pad water will stay on until the RH exceeds the max level or the temperature drops below the bank two setpoint. Once it turns off, it will only come on again if the RH falls below the pad water RH low level (or if all fans are on it will come back on again after 20 mins if the RH is below the RH max level).

Binary mode

In binary mode the fan banks must be arranged in a "binary weighted" sequence so that bank 2 has twice the effect of bank 1 and bank 3 has twice the effect of bank 2. The controller then operates in a similar way to the normal mode except it tries to switch on combinations of the fan banks to achieve exactly the amount of cooling necessary. By choosing combinations, 7 levels of cooling become possible instead of just the 3 available in normal mode.

Just as in normal mode each bank has its own setpoint and as soon as the temperature exceeds that setpoint the highest bank of fans allowed for that setpoint will come on. Then, at 3 minute intervals, lesser fans will come on in binary sequence until the temperature no longer exceeds the setpoint (+0.5^{o} differential). At each 3 minute step, the RH is checked to see if the pad water can be activated instead of the next level of fans.

Heating

Air heating can be by either proportional control or ON/OFF control. Proportional control is normally used in conjunction with a boiler heating water pipes. This provides a very gentle heat and the heating pipes can be positioned either under the grow beds or between the rows of plants. In this way less heat need be supplied as compared with general warm-air heating. Water pipe heating is gentle, economical and avoids sudden drying of the air. The heating uses a PID algorithm in order to operate the heating quickly if sudden changes in temperature are detected. The heating is used to control both the temperature and the relative humidity.

Time Zones

Up to four time zones may be selected together with the possibility of pre-dawn heating to give a very detailed temperature profile. At the boundaries between time zones, temperature ramp-rates may be specified which cause the controller to ensure gradual changes of temperature from zone to zone. The PC software provides a mimic diagram which clearly shows both the venting and heating profiles to assist the grower in setting the system for optimum performance. Remember that although the controller can always switch to fan/pad cooling it can only switch back to passive venting twice in each time zone.

Humidity Control

Humidity is controlled by varying the heating and venting temperature set points, by switching on stirring fans, by fogging and, in extreme conditions, by purging. Temperature set points are varied, within user-set limits, in order to increase venting to allow excess humidity to escape or reduce venting in order to try to retain humidity from transpiration. Within a user-set "proportional range" this effect is progressive. Outside the proportional range the effect will be at one of the user-set limits.

Again, the Compugrow software assists the grower in optimizing these settings by providing graphical interpretation of settings in real time.

Purging

Two purging regimes are possible. First is the "timed purge" which can be enabled by the grower to crack the vents periodically whenever they are closed. If passive vents are not available then a fan will come on for a short time. This has the effect of allowing an air change in order to release trapped humidity and also introduce CO_2 from the outside.
The second method is one set by the grower to only be invoked when the humidity is excessive. When active this has the effect of raising the heating temperature and periodically nudging open a vent (or switching on a fan) to allow the warm moist air to escape. The fresh air entering is warmed by the raised heating temperature (which tends to dry it further) but gradually the transpiring crop will raise the humidity until the vents are again nudged open.

Fogging

Fogging may be used to assist with cooling or to increase humidity in dry weather. A fog pump output comes on continuously while the fog pulse outputs come on in sequence to produce puffs of fog in each zone. One zone is built into the controller and a further 3 zones are possible if an output expander is fitted.

Stirring fans

Two stages of stirring are provided. This is normally set to come on whenever the vents are closed, when humidity is excessive or when injecting CO_2. Stirring may be disabled during fogging if desired

Shading

Shading operates to maintain the light level below a user set maximum. The controller uses the outside solar sensor to calculate the level of light that will be available inside the greenhouse with every combination of shade cloth available. It then selects the combination that will bring the light level below the maximum level set by the user. Shading always operates in such a way as to protect the crop from excessive sun. For example, when changing from shade 1 to shade 2, shade 2 will be closed before shade 1 is opened. After shading has been increased, it will not be decreased until there has been at least 10 continuous minutes of low light conditions that would suit a lesser level of shading.

Thermal blanket / blackout control

This output can be used either as a dedicated thermal blanket or for blackout cloth control. When used for blackout it can be set to operate during specified time zones and to keep closed for a specified time per day. Usually the time zones chosen are TZ3 (evening) and TZ1 (morning). When set this way it is important that the end time of TZ3 is late enough to ensure almost total darkness when the cover is removed. Similarly, TZ1 must start well before the sun comes up. When all blackout cloth is closed it is possible for humidity to build up. Purging may be enabled to crack the blackout and at the same time crack the roof vents to allow the humidity to escape. Note however that for some plants the dark period must be continuous in which case this method cannot be used. If this is the case then the exhaust fans can be specified to be used to switch on for short periods to purge the humidity. The blackout will open during TZ1 when the required dark period has been reached.

Lighting

Two outputs for supplemental lighting are provided. This allows lights to be arranged in two banks which may be switched on alternately to ensure a lesser draw on the power supply as compared with a single large bank or alternatively to provide one bank for photoperiod manipulation and the other for supplemental lighting. The lighting algorithm may be used to either provide minimum day length, a minimum light level during some time zones or to top-up the accumulated sun-light for the day. In the last application it can be set to operate only during hours when electric power is available at a lower rate. A 52 week schedule of required light levels and day lengths may be entered to cause an automatic update of settings every Saturday night.

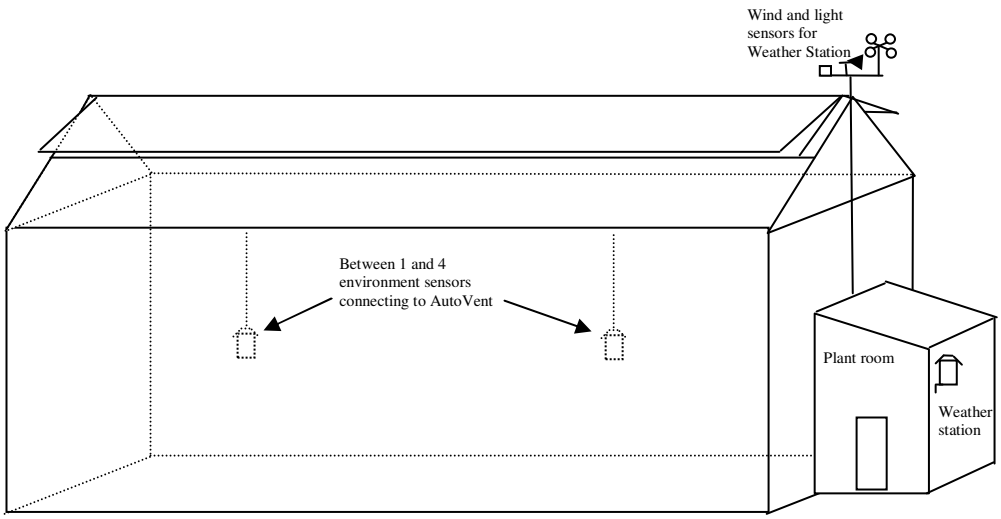
Optional CO_2

CO_2 is measured and injected providing 1) there is sufficient light or 2) the vents are below a set limit. The user may specify any desired level of CO_2 from 0 to 2000ppm and the system will try to provide this when the above conditions are satisfied. It may be set to only operate during certain time zones.

PC interface

The optional PC interface allows the settings to be viewed and set from the user-friendly CompuGrow software. It also facilitates the collection of measured data and events from the controller for logging to the hard drive whence it may be displayed graphically for ease of interpretation. The computer interface also allows for alarms to sound at the PC (via the PC sound card) or even be auto-dialled out to a telephone or pager (via the PC MODEM).

System layout suggestions



The ideal installation will have a plant room at one end of the greenhouse (the south end in the Southern Hemisphere) to locate the control equipment. This room should be constructed to provide a dry, shaded and well ventilated environment for the controllers. Typically, the Weather Station will be mounted on an outside wall of the plant room and the wind gear will be mounted at the same end, about 1.5m to 2m above the apex of the house. Bear in mind that a single Weather Station can supply weather data to a number of greenhouses and in this case will normally be mounted on an end house in a row of greenhouses. The end chosen should preferably be the end most exposed to any strong prevailing winds.

Inside the house, the Enviro Sensor (temperature/RH) aspirated boxes are suspended on chains so that their height can be adjusted to ensure that they sample the air from just above the crop canopy. Up to four Enviro Sensors may be used and their readings can be averaged in order to derive the most representative values possible. Each Enviro Sensor has a unique address (set by jumpers on its circuit board) and may have a solar sensor and/or a CO_2 sensor connected to it. It is a good idea to have more than one solar sensor so that when shadows fall on them from roof beams etc the average is not unduly affected. Internal light sensors should be positioned horizontally below any shade cloth and with maximum exposure to the northern sky (southern sky in the Northern Hemisphere). Full control is provided to specify which sensors are included in the "average" which is used to control the environment.

In large houses, it may be desirable to divide the house into a number of environmental zones. In this case each zone will be connected to its own AutoVent controller which in turn will have its own Enviro Sensor boxes. By using separate controllers in this way any failure will be limited to a single zone.

Settings

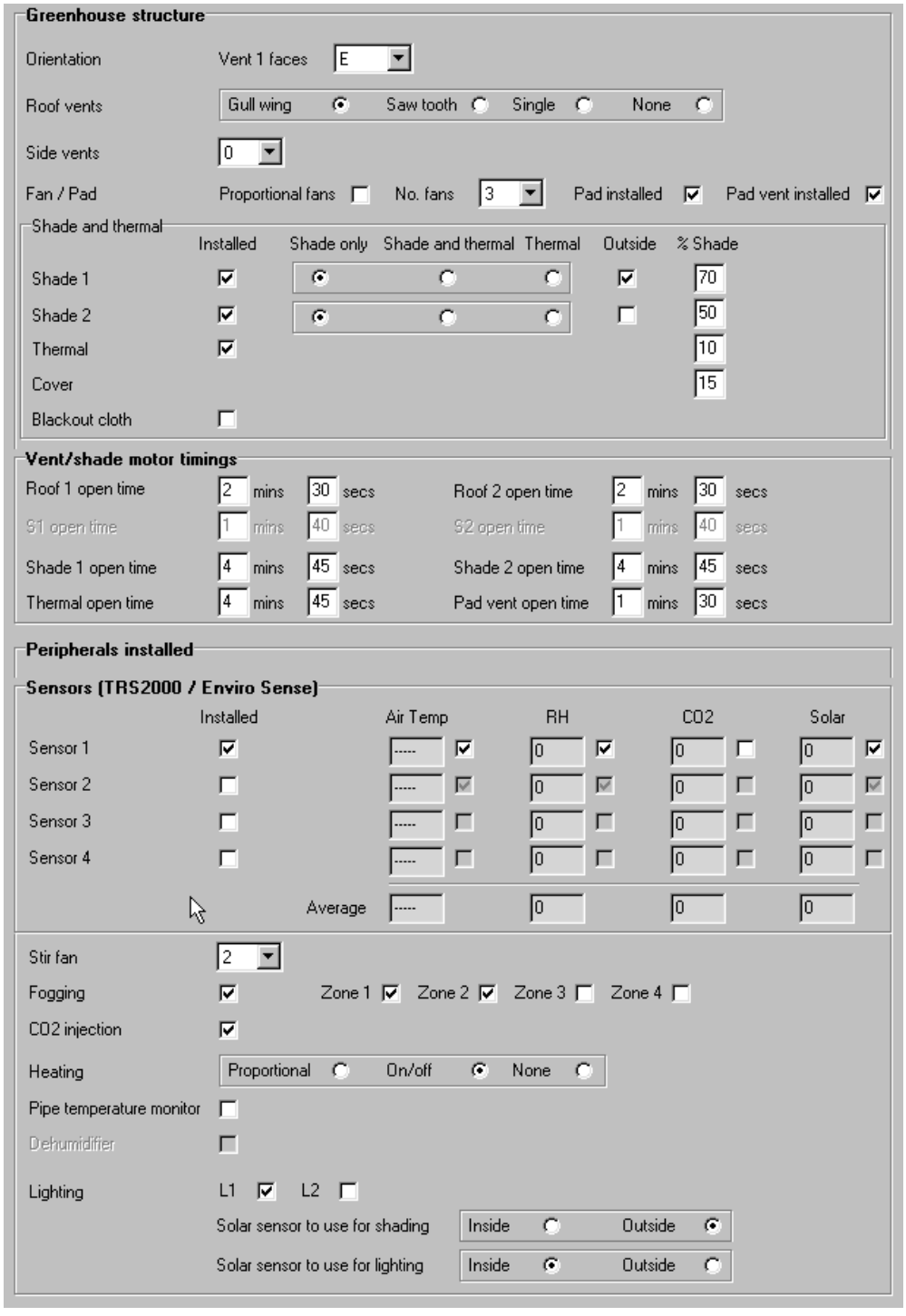
Introduction

It is far easier to set the controller from the PC than from its front panel as it avoids the tedium of entering, exiting and navigating the many menu screens. For this reason we will concentrate on entering settings at the PC. Once familiar with the PC settings, it is relatively easy to find the equivalent settings within the controller menu system.

General guidance for setting the controller

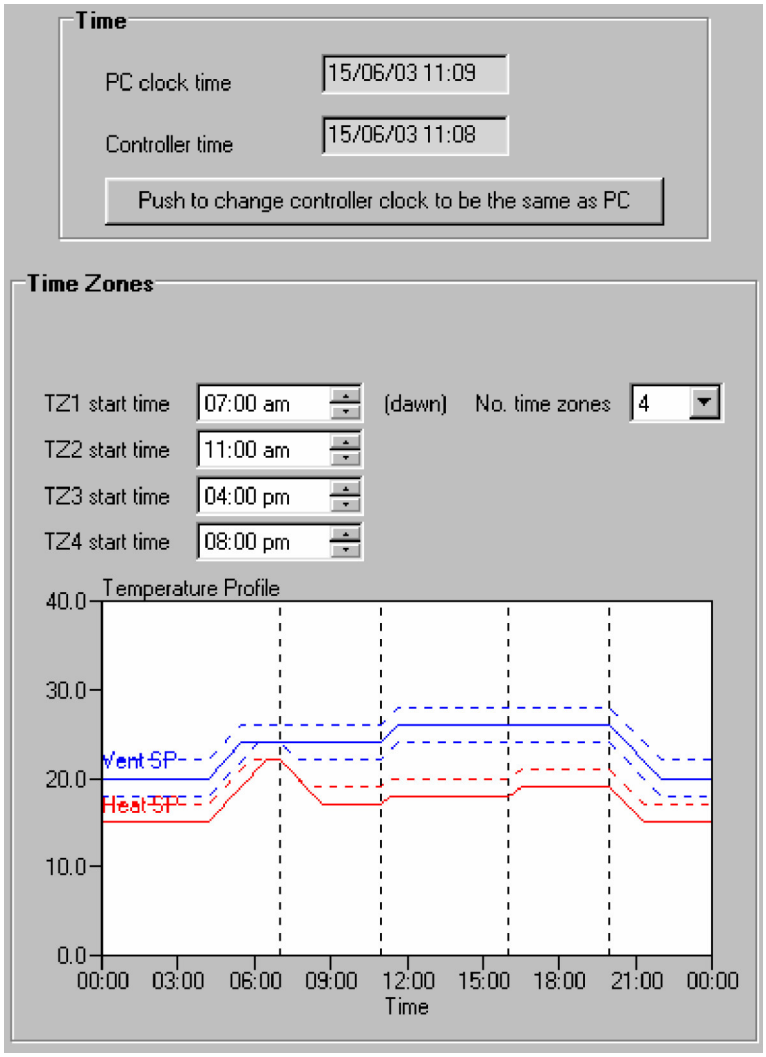
Refer to the CompuGrow software manual for instructions to establish communications between the PC and the AutoVent controller and once this has been established proceed as follows:-
We will work through the settings in the order that is most likely to be followed in practice.

Configuration tab



The configuration tab is used to specify details about the installed equipment. Here you select the type of greenhouse, which direction vent 1 faces (normally choose the roof vent on the east side for vent one). Also specify the total time taken to move each vent (or shade cloth) from fully closed to fully open.
The peripherals connected must also be selected. Note that you may install up to four inside enviro sensors. These can be positioned at key points inside the greenhouse. When doing this you must set the address of each sensor by changing its jumper positions as described in section 5. Then in the configuration tab, enable each of the enviro sensors by checking it as "installed" and then tick each value that you want to be used for calculating the average values. NOTE that it is the average values that are used for control purposes.
Also select the type of fans, heating, shading etc that you have installed and working.
The pipe temperature monitor is used to monitor the temperature of the heating pipe at its entry to the greenhouse. If this is installed then the controller may be set to maintain this at a minimum temperature even when heating is not required. This will help the heating to respond quickly when it is required as the pipe is never allowed to get really cold.

Time tab



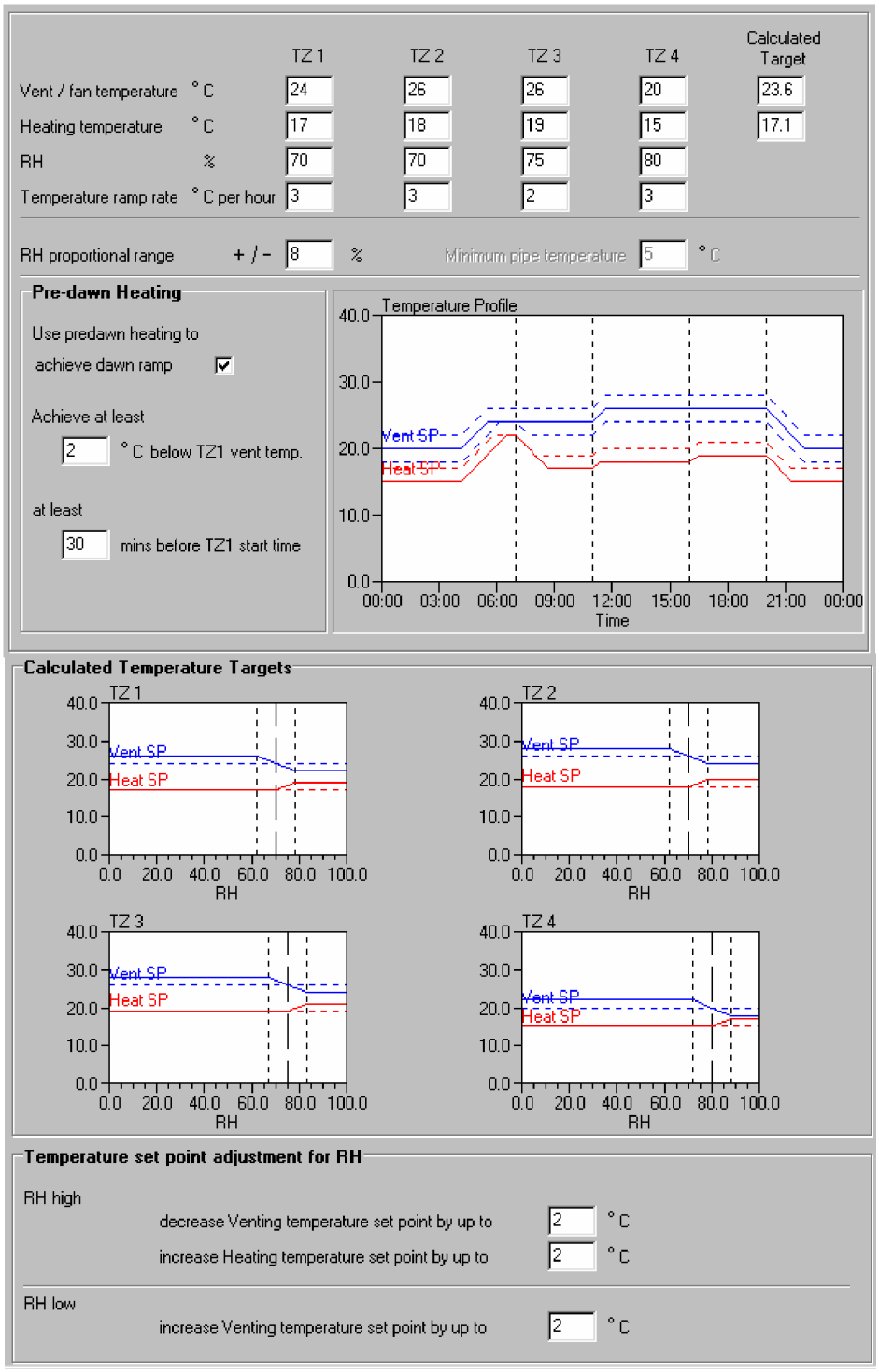
The time tab is used to set the controller clock (by making it the same as the PC clock). Of course, it is a good idea to correct the PC clock and calendar before setting this. You also need to specify the start time for each time zone. Note that time zone one must start at dawn if pre-dawn heating is to be used.

Settings 1 tab

The two settings tabs allow you to enter all of the settings for temperature and humidity to construct the required profile for your crop. Settings 1 starts with the target temperatures and humidities for each time zone. It also has entries for maximum ramp rates between time zones. To assist you in visualizing the complete profile a graphical representation is displayed showing every change that you make. Note that at the end of the row of vent temperature set points and heater temperature setpoints is shown the calculated temperature set point. This is the actual set point that the controller is working to at this instant. It is derived from the set point for the current time zone, the relative humidity rules (at the bottom of settings 1 tab) and the maximum ramp rate.

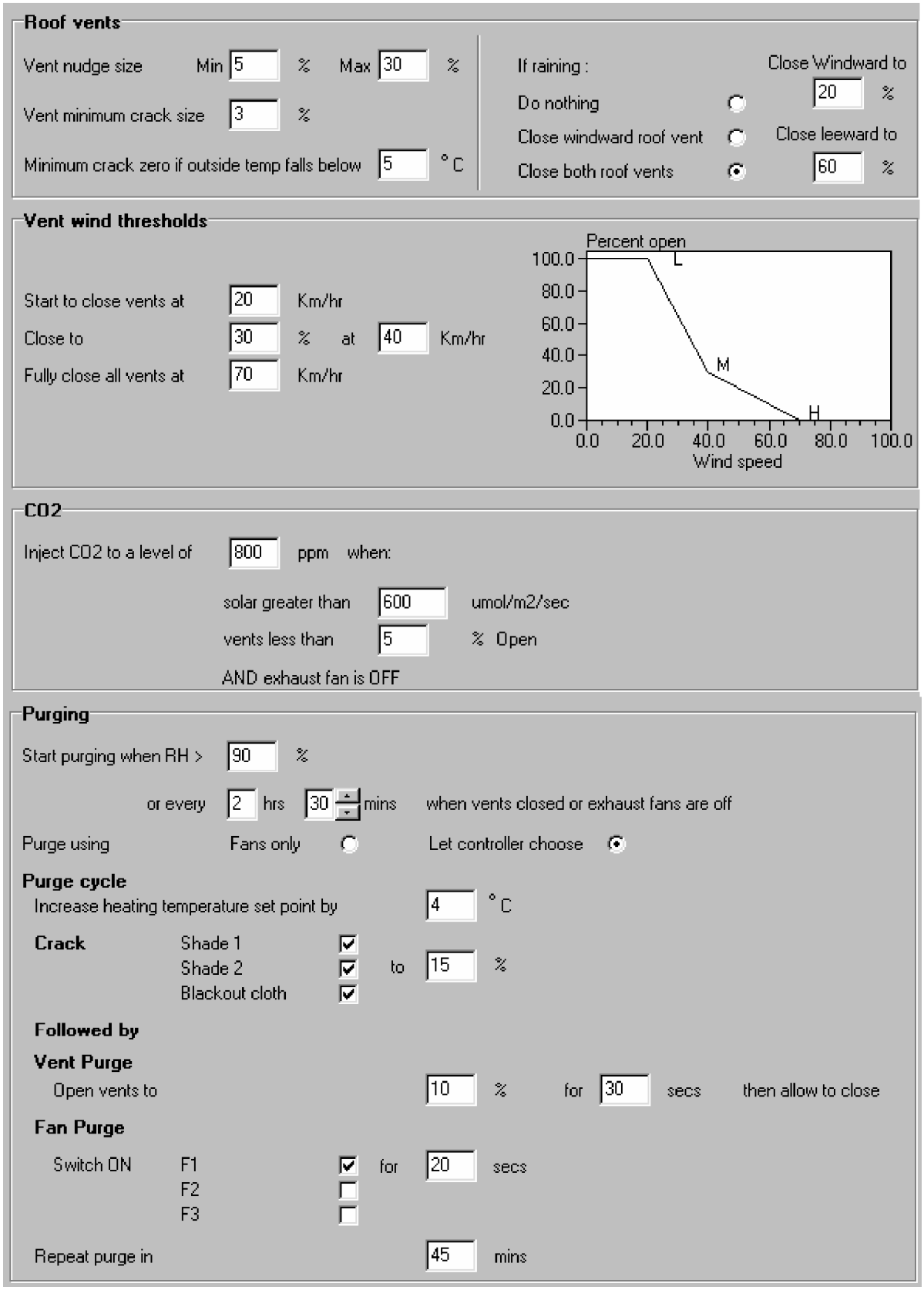
The rules for modifying the target temperatures to take into account high or low humidities are also entered at the bottom of settings 1 tab, and again, a graph for each time zone can be viewed in order that you can see the effect of the rules on the temperature set points. Note that these rules modify the target temperature setpoints to create the " calculated target" setpoints shown at the end of the row of setpoints for each time zone.

Settings 1



Settings 2 tab

The second settings tab holds a range of less frequently changed settings.



The first group in settings 2 is concerned with vent nudge sizes. The controller will calculate the most appropriate vent nudge size within the range specified, based on outside temperature, wind speed, current vent position, etc. Normally this range is set with a minimum of about 5% and a maximum of perhaps 20% to 30%. It is not possible to set the minimum nudge size below 2% for safety reasons. A minimum crack size may also be set here that forces the vents to always maintain a small crack and provide some ventilation even when the temperature is very low. An override is provided to fully close the vents if the outside temperature falls below the specified level.

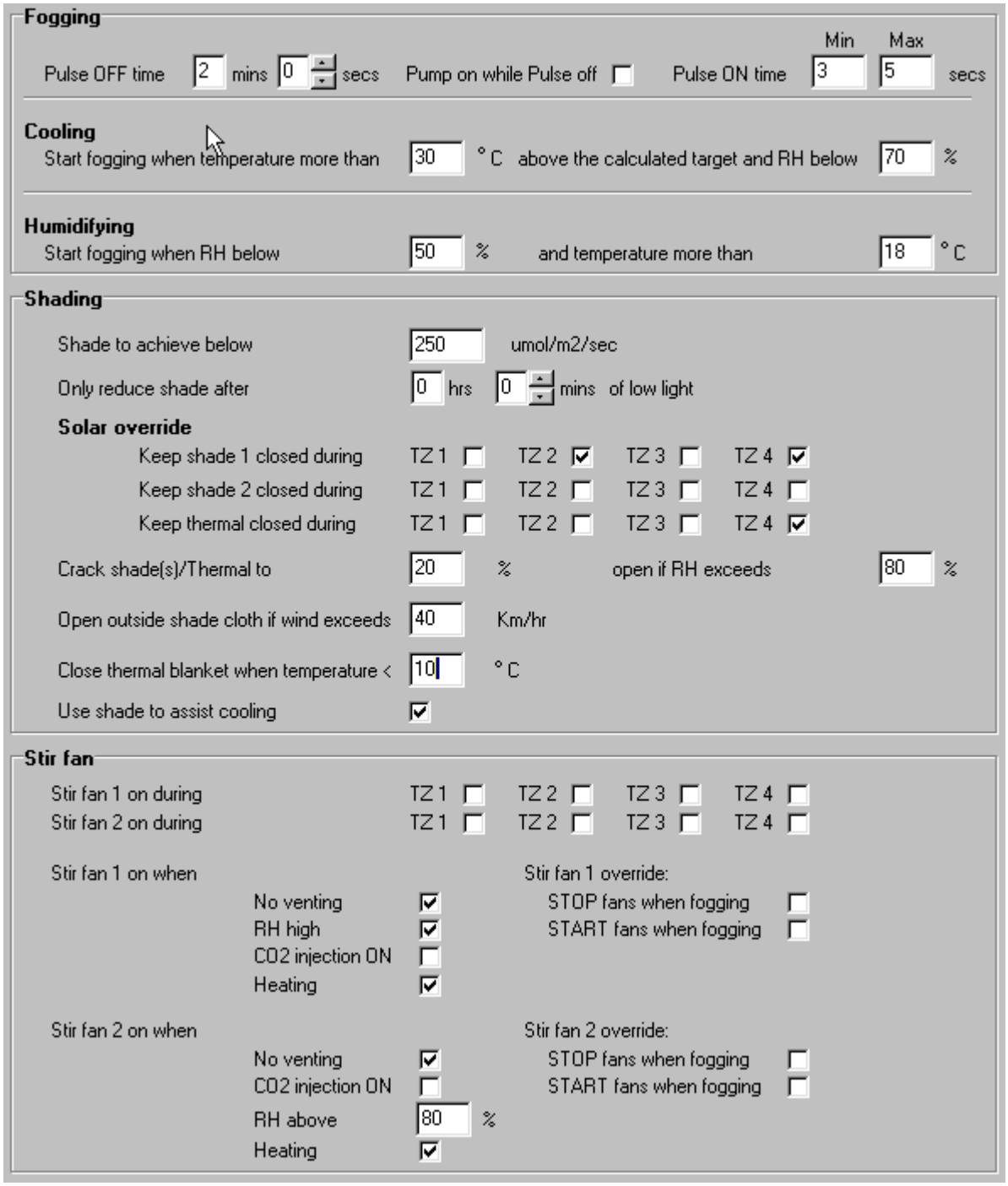
If rain is detected then the vents can be set to close to specified limits.

The wind thresholds are specified next. Note that the windward vent will always be the first to close and the last to reopen so if the vents close to 30% due to high wind, the windward vent will be fully closed and the leeward vent 60% open. Again, a graph is provided to show pictorially the effect of settings here. In the case of the side vents, there is a wind speed setting to close the windward vent and the leeward vent will close when the "close all vents" speed is approached.

CO_2 is enabled for each time zone and if enabled will only become active if the rule specified is met; ie the CO_2 level must be below the set point, the inside solar irradiance must be above its setting, the vents must be below their setting and the exhaust fan must be off.

Purging is only effective when there is no ventilation ie all vents closed and fans stopped.
Two purging regimes are possible. First is the "timed purge" which can be enabled by the grower to crack the vents periodically whenever they are closed. If passive vents are not available then a fan will come on for a short time. This has the effect of allowing an air change in order to release trapped humidity and also introduce CO_2 from the outside.
The second method is one set by the grower to only be invoked when the humidity is excessive. When active this has the effect of raising the heating temperature and periodically nudging open a vent (or switching on a fan) to allow the warm moist air to escape. The fresh air entering is warmed by the raised heating temperature (which tends to dry it further) but gradually the transpiring crop will raise the humidity until the vents are again nudged open. During a purge, the shades can be set to crack to allow air to move freely up to the roof level.

Settings 2 continued



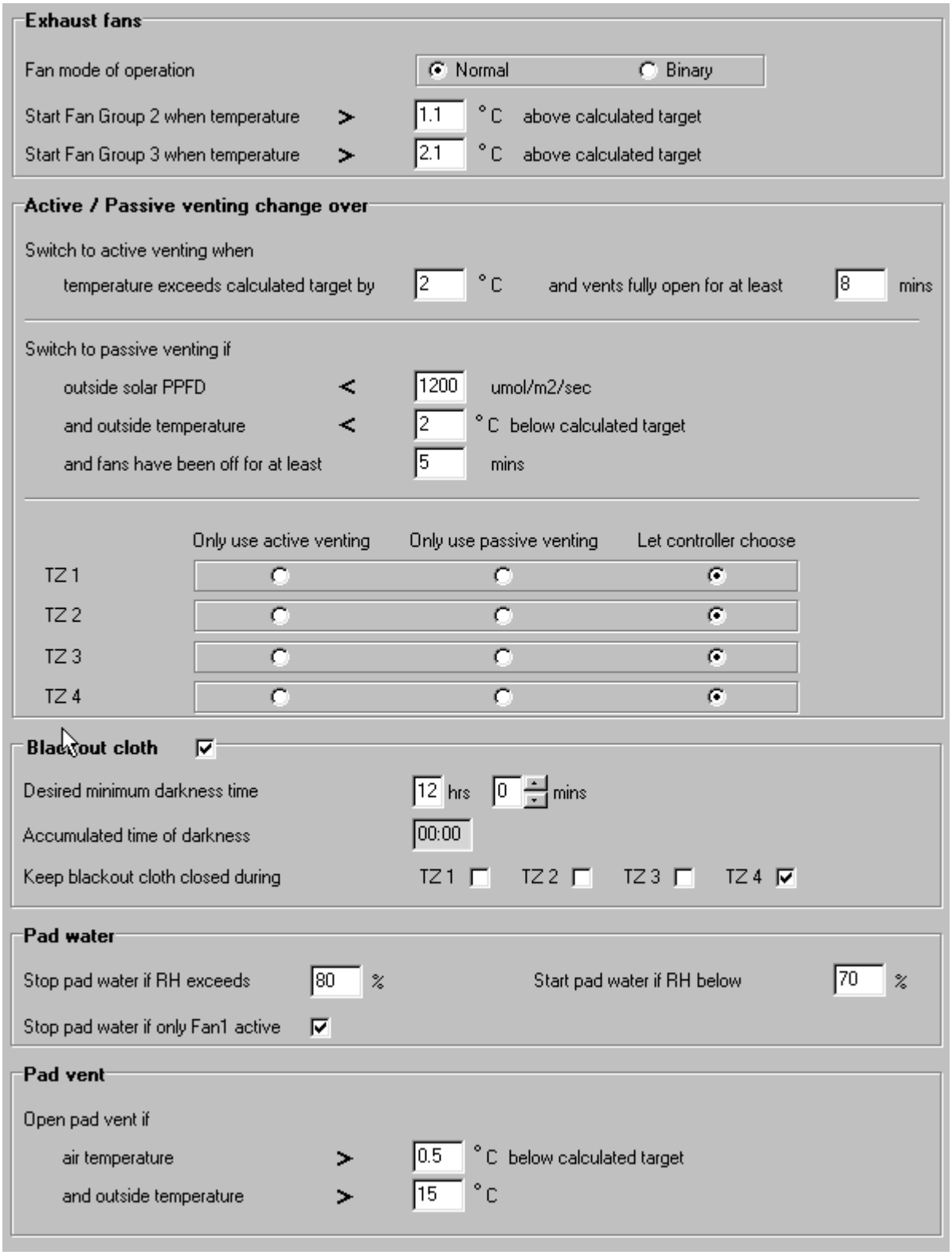
Fogging can be used to either cool the air or to humidify it. Of-course in either case it will humidify and cool but there are two separate rules to address both reasons for using it

Shading

The two levels of shading can be used to maintain the inside light levels below a specified point. The controller will automatically calculate the best combination of Shade 1 and shade 2 and will always "close before opening" when changing over from one to the other. In addition, time zones may be specified during which the shades are forced to be closed. This is useful when using them as thermal screens during the night. Finally, they can be set to crack open if humidity reaches above a specified level. They can also be set to crack during purge operations as explained previously.

The stir fan(s) can be set to come on under various conditions. First of all they may be forced on during particular time zones. And if not forced on they can be set to come on whenever there is no venting, for high humidity conditions, when injecting CO2 and when heating. If one or more of these conditions is true then the fan will come on.

Settings 3



Fan and Pad

If the vents are fully open and the temperature continues to rise then the system will switch over to fan/ pad control. This will also occur if the temperature rises when the vents are disabled or restricted from opening fully due to wind or rain. The exact point at which this happens can be set by the user. Once switched to fan/pad, the system can switch back to passive venting only twice during any time zone. This is to avoid the possibility of the system constantly cycling between passive and active venting.

There are two modes of operation for the fans "normal mode" and "binary mode". Each of the three fan banks has its own set point. These are based on the time zone setpoint plus an offset for each of the fan banks. Bank 1 has zero offset and banks 2 and 3 have a user set offset applied. Typically, bank 2 will have an offset of 1 to 2^{o}C and bank 3 an offset of 2 to 4^{o}C

Normal mode

On entering the fan pad mode the system looks at the measured temperature and switches on the appropriate number of fan banks. These will start up with a 5 second delay between each group to avoid excessive loading on the electricity supply. After a further 3 minutes if the setpoint is still exceeded (by more than the 0.5^{o}C differential) then the pad water will start providing the RH is below its set point. If all fans are on then the pad water will start if the RH is below its maximum level. Once started the pad water will stay on until the RH exceeds the max level or the temperature drops below the bank two setpoint. Once it turns off, it will only come on again if the RH falls below the pad water RH low level (or if all fans are on it will come back on again after 20 mins if the RH is below the RH max level).

Binary mode

In binary mode the fan banks must be arranged in a "binary weighted" sequence so that bank 2 has twice the effect of bank 1 and bank 3 has twice the effect of bank 2. The controller then operates in a similar way to the normal mode except it tries to switch on combinations of the fan banks to achieve exactly the amount of cooling necessary. By choosing combinations, 7 levels of cooling become possible instead of just the 3 available in normal mode.

Just as in normal mode each bank has its own setpoint and as soon as the temperature exceeds that setpoint the highest bank of fans allowed for that setpoint will come on. Then, at 3 minute intervals, lesser fans will come on in binary sequence until the temperature no longer exceeds the setpoint (+0.5^{o} differential). At each 3 minute step, the RH is checked to see if the pad water can be activated instead of the next level of fans.

Blackout control

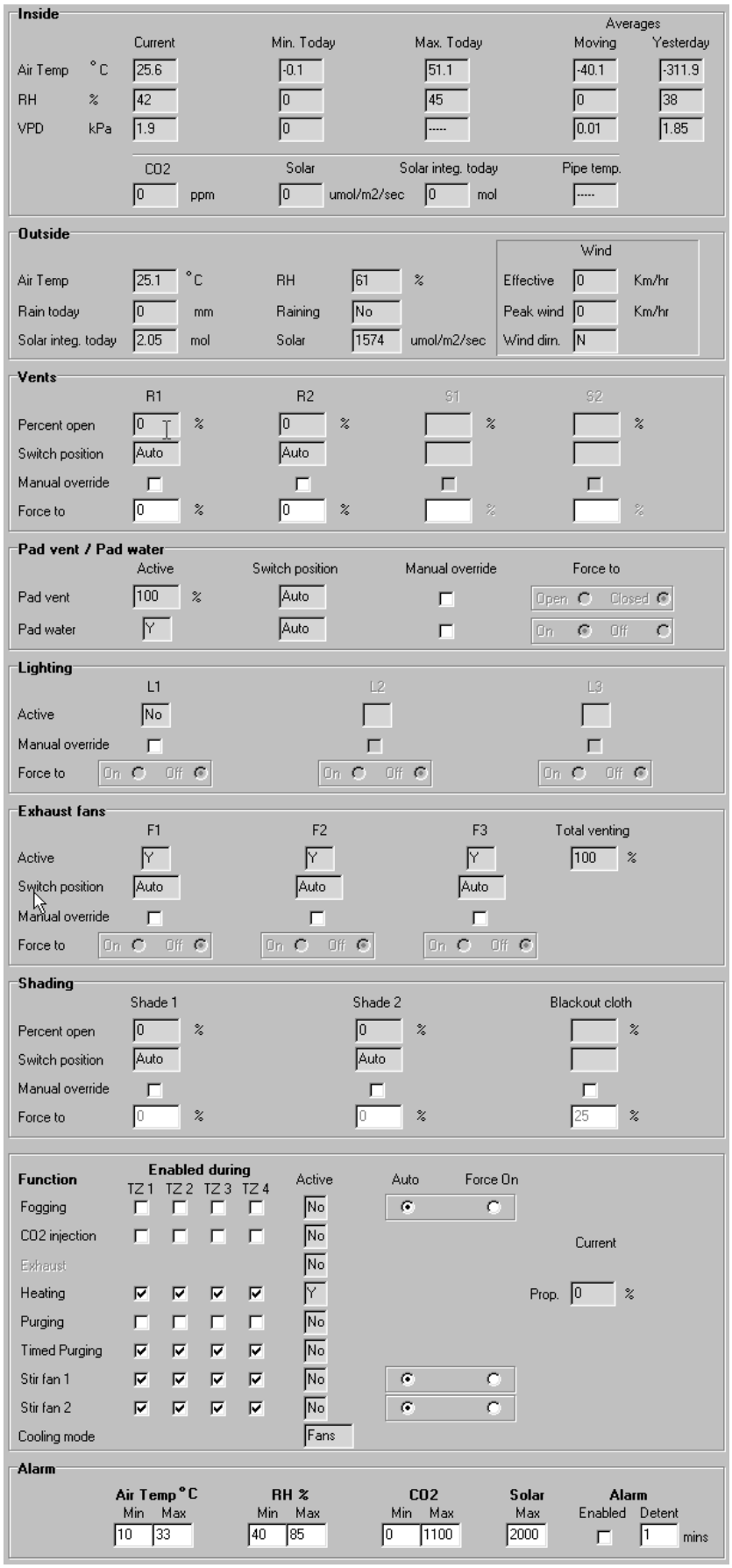
This output can be used either as a dedicated thermal blanket or for blackout cloth control. When used for blackout it can be set to operate during specified time zones and to keep closed for a specified time per day. Usually the time zones chosen are TZ3 (evening) and TZ1 (morning). When set this way it is important that the end time of TZ3 is late enough to ensure almost total darkness when the cover is removed. Similarly, TZ1 must start well before the sun comes up. When all blackout cloth is closed it is possible for humidity to build up. Purging may be enabled to crack the blackout and at the same time crack the roof vents to allow the humidity to escape. Note however that for some plants the dark period must be continuous in which case this method cannot be used. If this is the case then the exhaust fans can be specified to be used to switch on for short periods to purge the humidity. The blackout will open during TZ1 when the required dark period has been reached.

Lighting

Two outputs for supplemental lighting are provided. This allows lights to be arranged in two banks which may be switched on alternately to ensure a lesser draw on the power supply as compared with a single large bank or alternatively to provide one bank for photoperiod manipulation and the other for supplemental lighting. The lighting algorithm may be used to either provide minimum day length, a minimum light level during some time zones or to top-up the accumulated sun-light for the day. In the last application it can be set to operate only during hours when electric power is available at a lower rate. A 52 week schedule of required light levels and day lengths may be entered to cause an automatic update of settings every Saturday night.

Status tab

The status tab shows the current readings and status of the environment both inside and outside the greenhouse. The VPD displayed is calculated from the inside temperature and the inside relative humidity and is provided for information purposes only

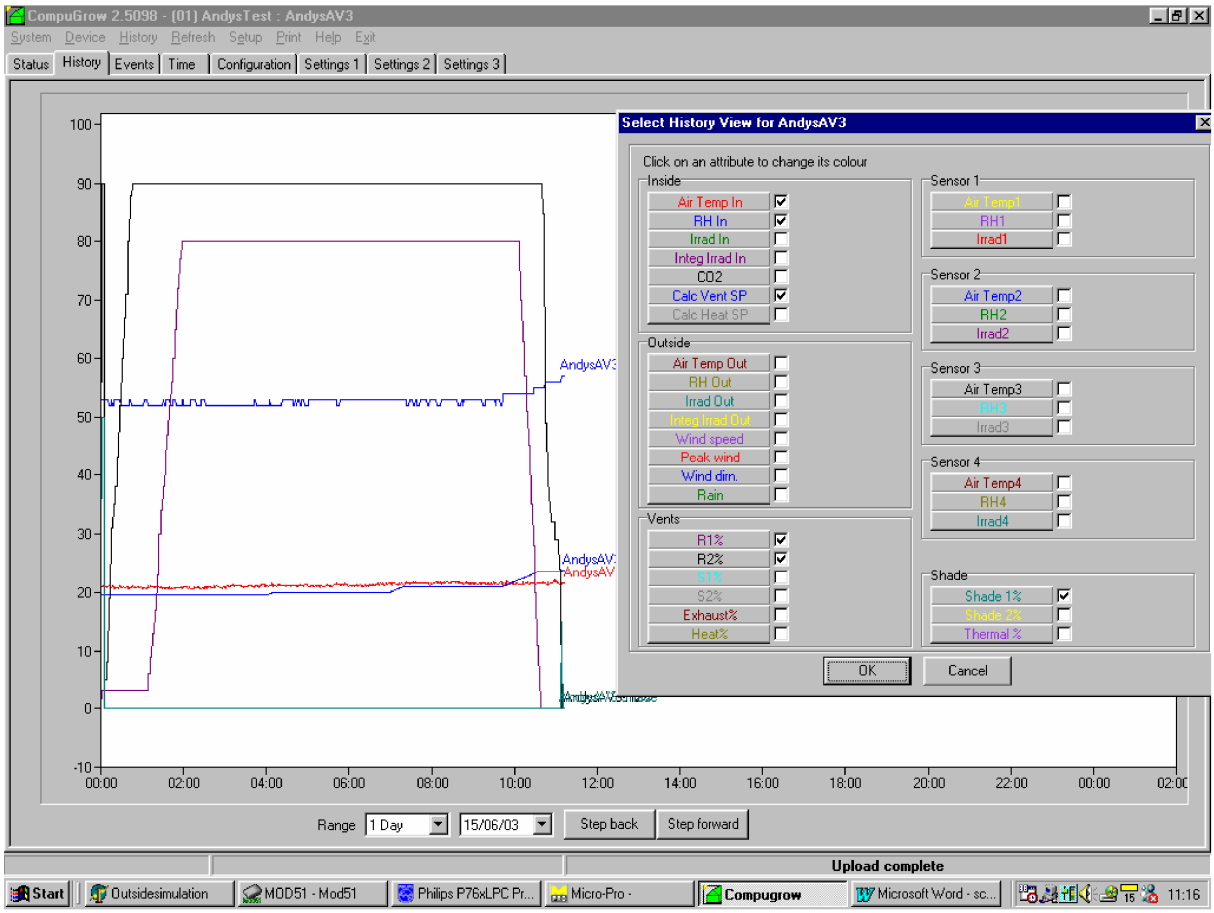


The status tab shows the current positions of all vents and screens and allows you to force them to move to a specified percentage open. As soon as the manual override is released the vents will return to the correct position as calculated by the controller.

It also allows you to enable/disable many other functions and see which are currently active. In addition it will allow you to force some functions to become active or force them off.

Finally, the status tab allows alarms to be set up. Do not make the tolerances too tight or else you will be plagued by nuisance alarms. Also make sure that you set the alarm detent for a few minutes to give the controller a chance to recover from sudden disturbances before sending an alarm.

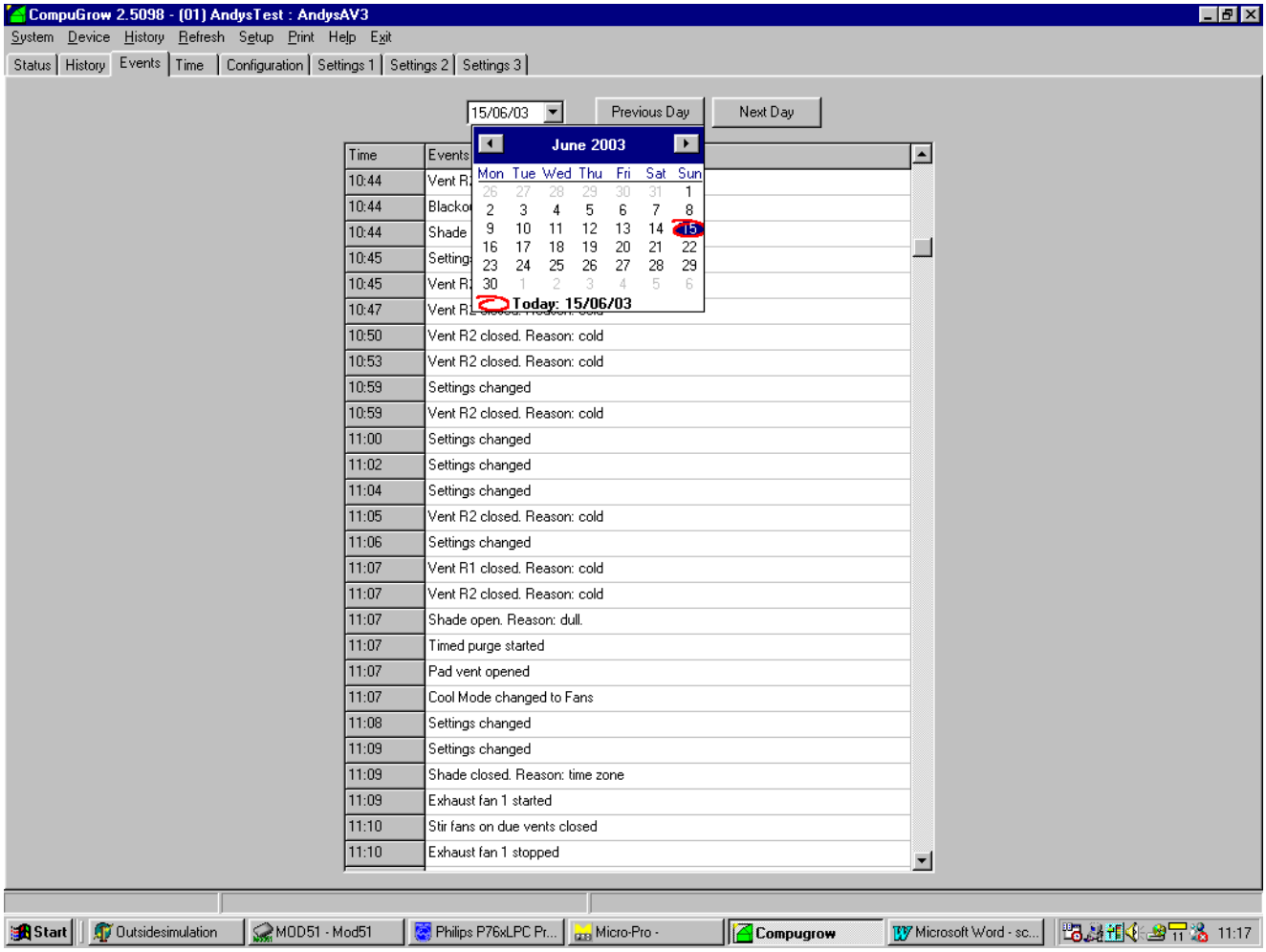
History tab



The history tab allows you to view graphs of all of the main measured variables. Note that the vertical scale is marked from 0 to 100%. For some variables this requires some interpretation as follows:-
Temperature – read directly in deg C or deg F

RH - read directly as a percentage
Solar irradiance - 100% corresponds to 2000umol/m2/sec
CO_2 – 100% corresponds to 2000ppm
Wind speed – read directly up to 100KPH
Wind direction 0 = North, 5 = NNE, 10 = NE, etc etc up to 75=NNW
Rainfall – read directly in mm of rain
Venting percentage – read directly
From the history tab, you can select History View on the main menu bar and can then switch on/off all variables and change the graph colours to obtain the view you require

Events tab



The events tab provides you with a detailed log of events and is very useful for trouble shooting. For instance, if you find the vents closed on a warm day you can look back in the log file to see exactly what time they closed and the reason for the closure eg high winds.

Saving and restoring settings

The controller settings can be saved/restored to the PC hard disk from menu item “setup/detailed device” accessed from the main menu bar. This is particularly useful when a controller is changed as the settings can be transferred to the new controller very simply.

The menu system on the controller

All of the above settings can also be viewed/changed from the menu system on the controller although this is far less convenient than from the PC it is reassuring to know that it is there should the PC ever break down..

Installation

Introduction – general comments

All electronic equipment will last longer if it is installed in a dry, cool shady location. Normally, a plant shed adjoining the greenhouse is used to house the control equipment in which case it should be well ventilated and any water/chemical activity should be positioned away from the controllers to avoid splashes and fumes causing corrosion. Wherever the controllers are installed it is critical that they are shaded from direct sunlight as this can easily cause them to overheat.
Remember that equipment exposed to direct sunlight can reach very high temperatures (over 70 deg C) even when the air temperature is relatively cool. If the equipment case temperature exceeds 60 deg C the warranty will be void.
The power supply to the control equipment should be protected from voltage surges by means of surge arrestors fitted at both the main and sub distribution boards. Local electrical engineers will advise on the size required which depends on the locality and the frequency of electrical storms in the area. In situations with frequent power disturbances a power filter or UPS may also be required to ensure continuous control of the system.
Use **STRANDED** CAT 5 (PATCH CABLE) for all data cabling and connections to remote sensors. The stranded CAT 5 cable is much less prone to breakage as compared with the more common solid style CAT5 cable. For the connection between the wind sensors and the weather station we recommend marine grade security cable. Autogrow Systems normally carry a small stock of this cable.

Installing the AutoVent controller

Fix the AutoVent controller to a wall in a shaded, dry, cool position and run the cables through the holes in the bottom. Note that the cable entry is via a split removable panel which allows the plugs and the IEC mains lead to be removed. Use cable ties to provide strain relief and run the field cables up the left hand side of the box and loop them at the top so that they easily bend when the face plate is opened/closed. Number the plugs from top to bottom in case they are ever removed. Section 5 has all of the connection information and wiring diagrams for this. Fit the IEC mains plug to the internal socket and check that the voltage label on the controller matches the supply voltage.

Installing the Enviro Sensor(s)

The Enviro Sensor(s) should be positioned just above the crop canopy in a representative position in the greenhouse. This means avoiding positions immediately in front of doorways or other positions that may experience draughts etc. By suspending it on a chain, it is easy to raise the sensor box as the crop grows. If more than one Enviro Sensor is installed then position these to get wide coverage of the greenhouse. These are then wired on a common cable which loops from one box to the next in “daisy-chain” fashion. Note that the terminator should be removed from all enviro sensors except for the one at the end of the cable. Also note that the communications address for each Enviro Sensor must be set by installing jumpers as listed below.

Address	Jumpers fitted
1	None
2	B
3	C
4	B and C

Installing the Weather Station

The wind gear should be installed about 1.5m above the apex of the greenhouse. If the Weather Station is to provide data to more than one AutoVent then it should be installed on a greenhouse at the end of the row, preferably in a position that has maximum exposure to any strong prevailing winds. The solar sensor may be installed at ground level or if this is liable to be shaded from the sun then it should be installed on the wind gear cross beam. Ensure it is on the northern end of the beam (southern end in the Northern Hemisphere) so that it is never shaded by the wind sensors. After connecting the cables to the wind sensors (see section 5 for connection diagrams) smear silicone grease over the brass terminals to prevent corrosion and then fit the plastic waterproof boots.
The Weather Station box should be installed in an accessible position where it can be easily serviced. The wind gear connects into the Weather Station and then the Weather Station connects to the first Autovent. Power to the Weather Station is provided from a 12V AC transformer external to the AutoVent controller. The reason for this is to limit the propagation of damage in the event of a high voltage surge due to lightning. Section 5 has full wiring diagrams for the Weather Station and wind gear.

Installing the PC interface

The PC interface box must be positioned close to the PC and is connected to the PC by means of a short serial cable. The PC interface box is powered from a small plug pack that supplies it with 12V AC power. The connection between the PC interface box and the first controller must be by means of a stranded CAT5 cable. See the wiring diagram in section 5.

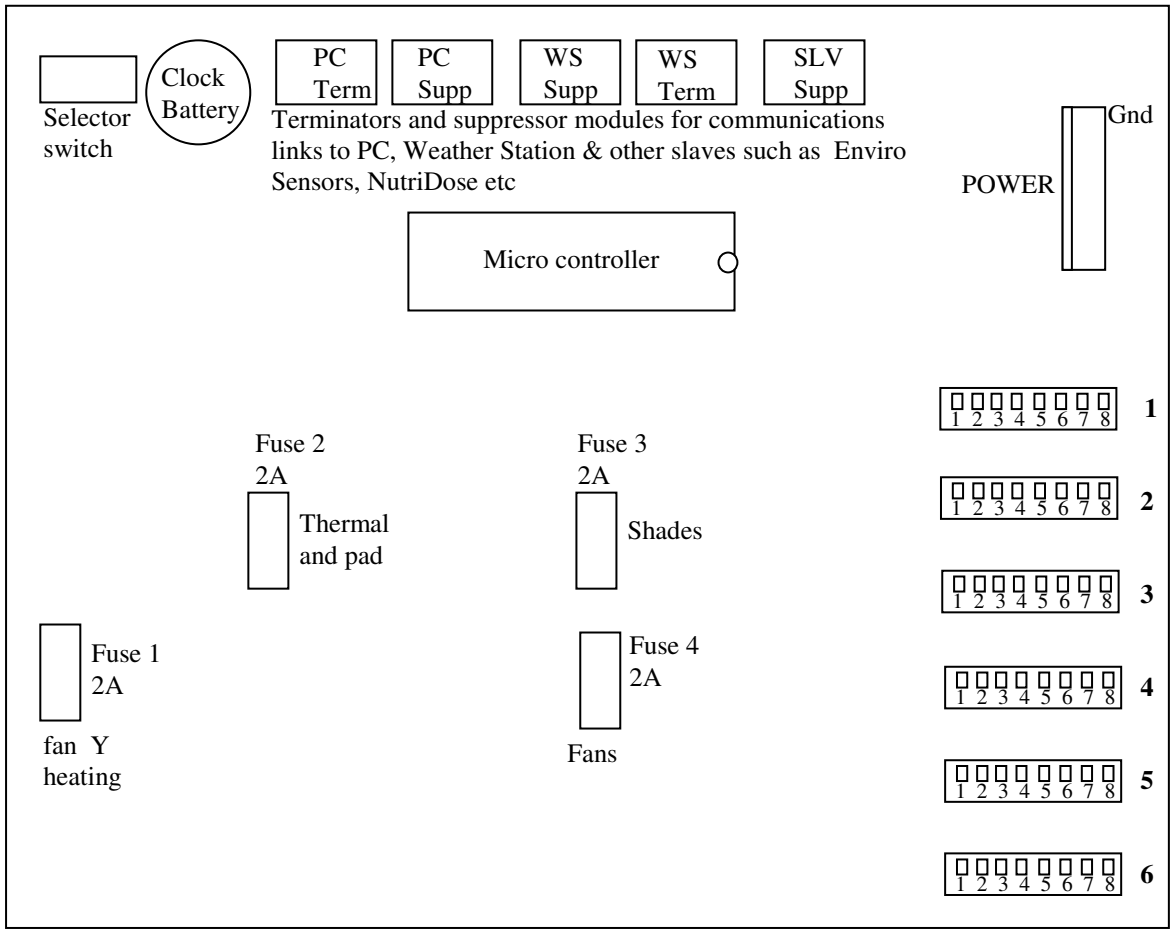
Note that the Terminators should only be fitted if this is the last unit in the daisy chain for that particular CAT 5 cable. For instance, if this is the last device on the cable coming from the PC then the PC terminator should be fitted. If it is the last device connected to the weather station then the Weather station terminator should be fitted. Similarly, if it at the end of the CAT 5 cable connecting to slave devices such as the Enviro Sensors or Enviro Minders then again, the Slave terminator should be fitted. In all other cases the terminators must be removed. Note that this rule does not apply to suppressor modules and all of these should be fitted for maximum protection against induced voltage surges such as those caused by nearby lightning.

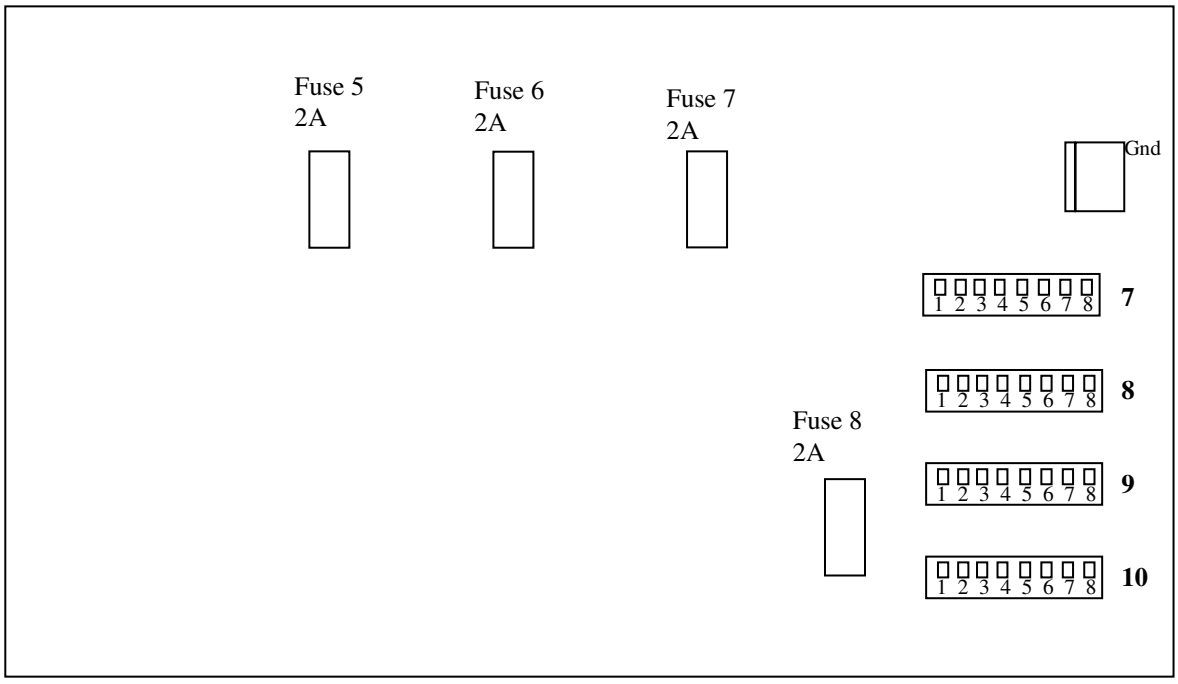
Connection Diagrams

POWER CONNECTOR

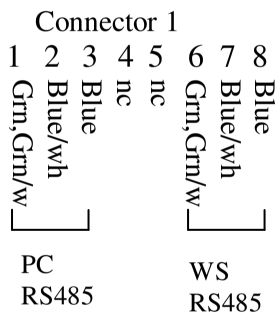
1	GND
2	11V
3	11V
4	11V
5	11V
6	11V
7	24V
8	24V
9	

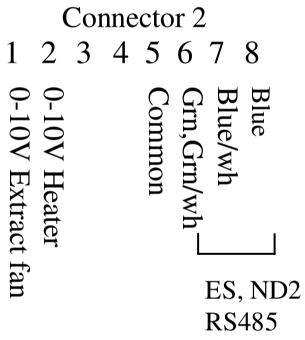
AutoVent connections

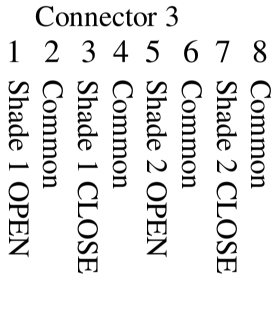


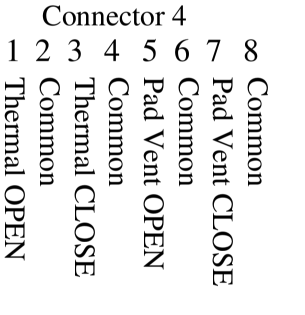


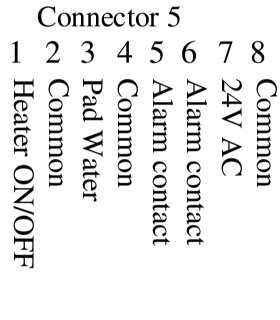
Autovent 3 Connectors

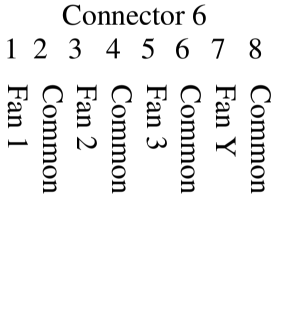


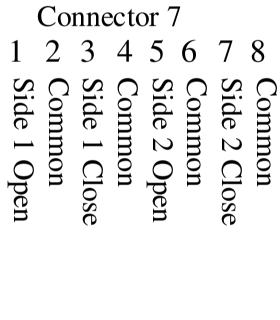


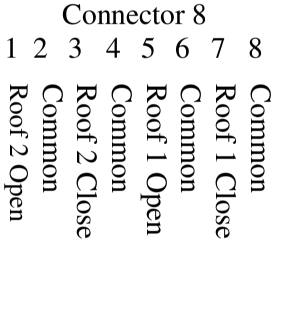


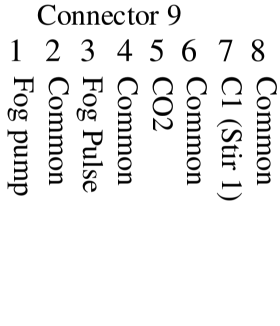


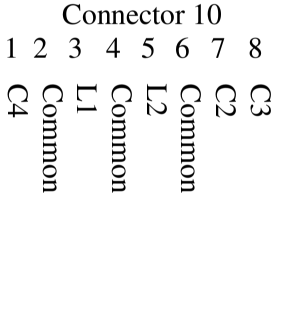






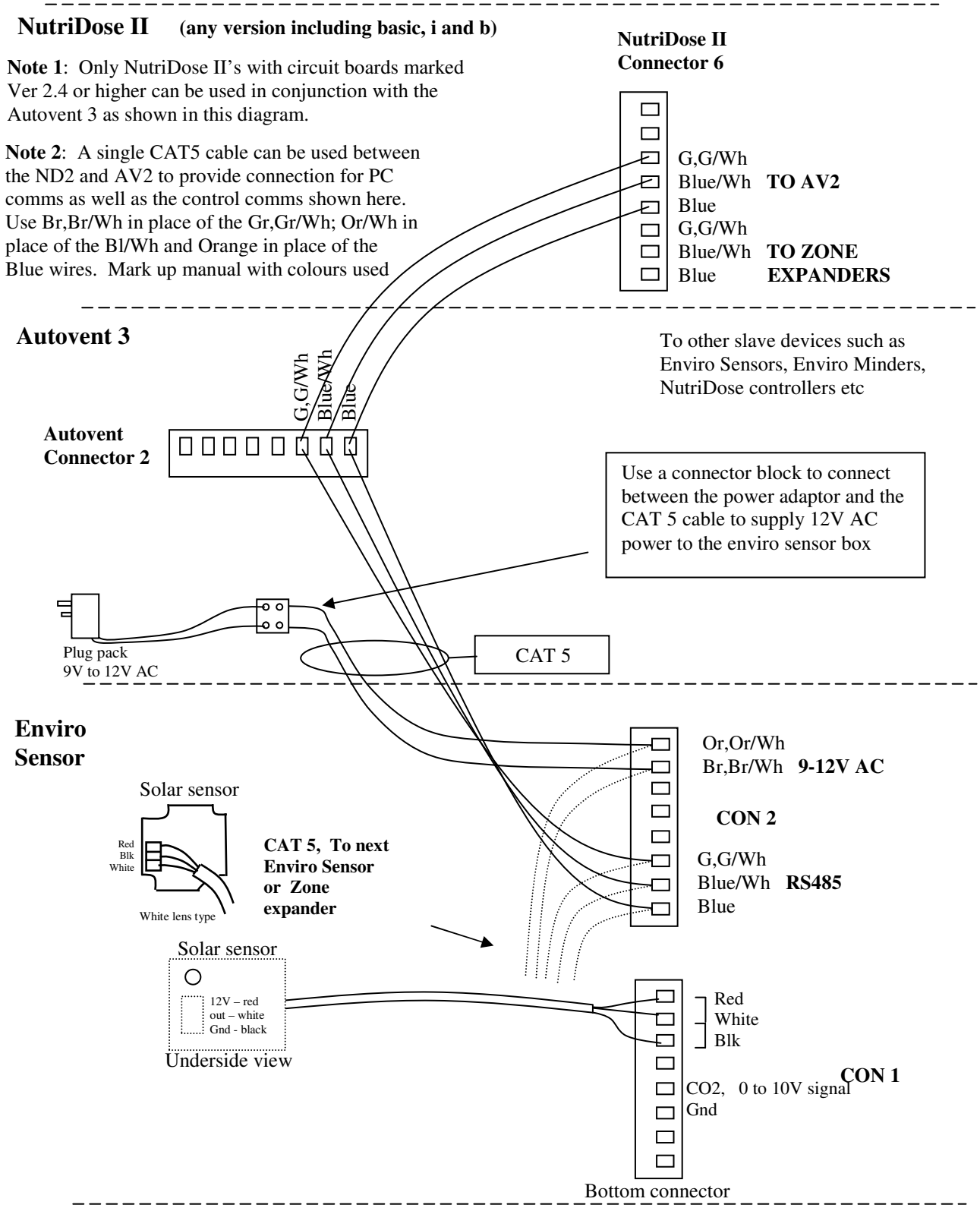




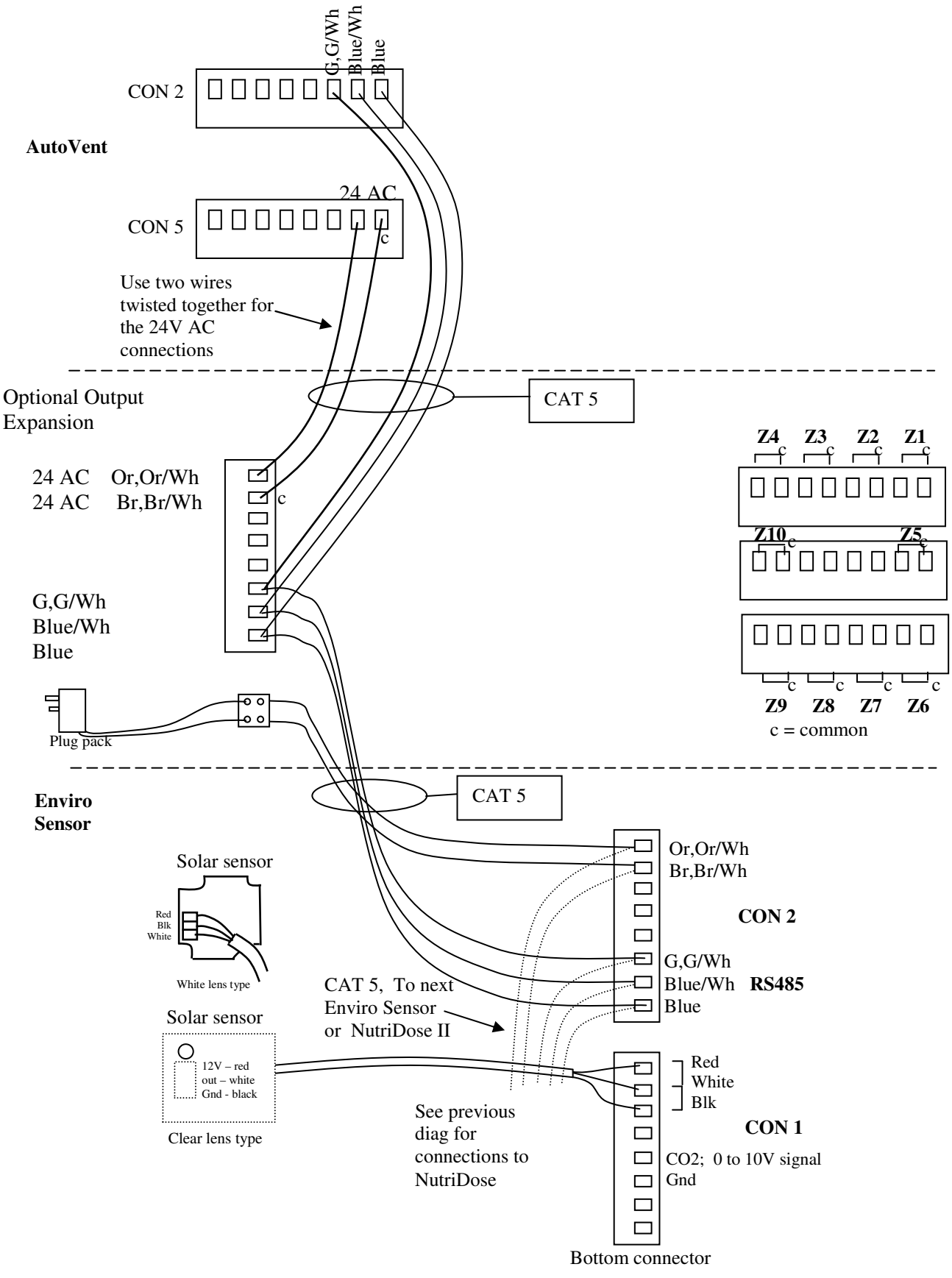


Enviro Sensor connections

The Enviro Sensors along with any NutriDoses connect in daisy-chain fashion onto the peripheral RS485 bus from connector 2 on the AutoVent. Remember, only the devices at either end of this cable should have terminators fitted. All intermediate terminators should be removed. All devices should have their suppressor diodes modules left in place. These suppressors are to protect the circuit from induced voltage surges. If a severe surge is experienced it is possible for the diodes to fail and prevent communications on the bus. In this event they may be removed and new ones ordered from Autogrow Systems.

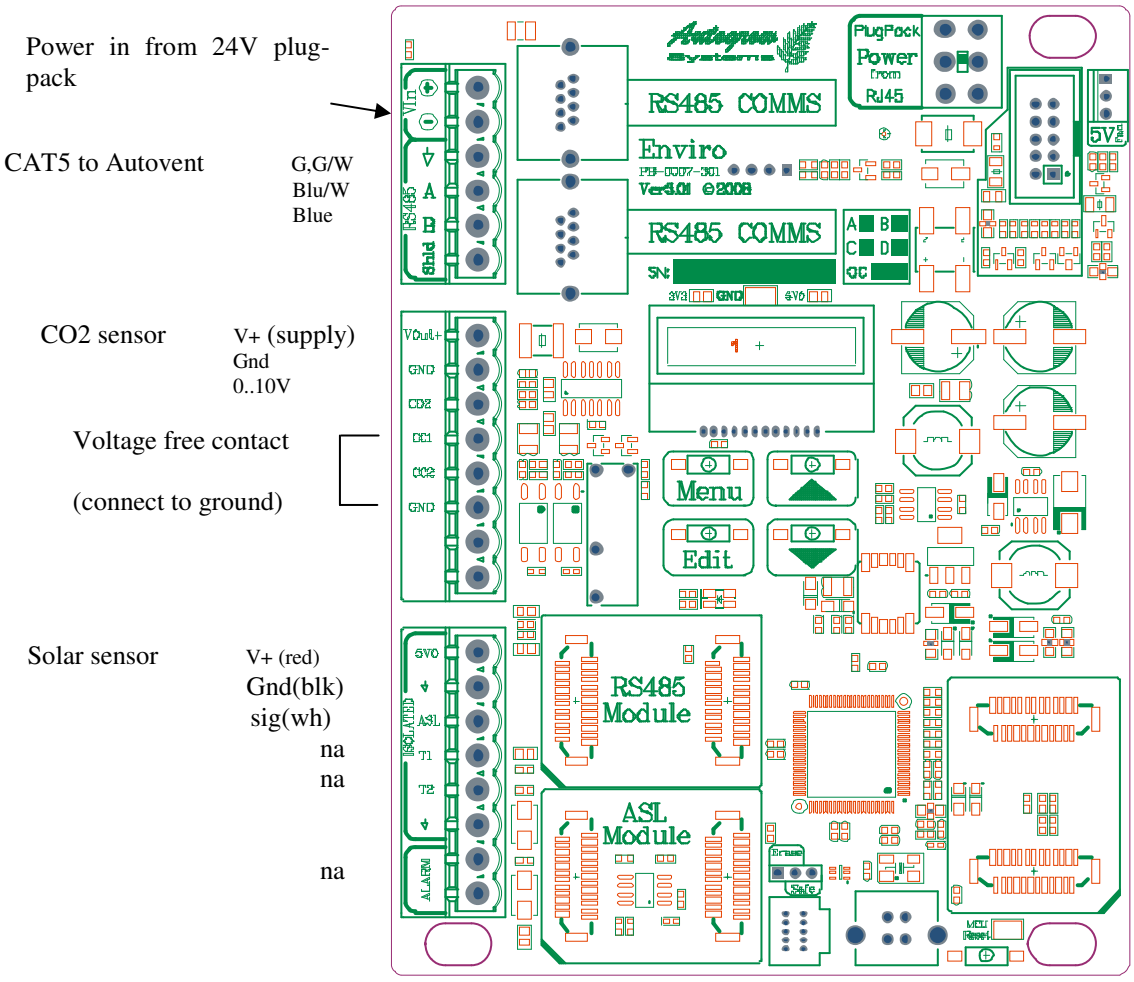


Connections from AutoVent 3 to Output expander (if used) and Enviro Sensor(s)



For the old style Enviro sensor as shown above a 12V plug pack should be used

For the new style Enviro sensor shown below a 24V DC plug pack should be used.

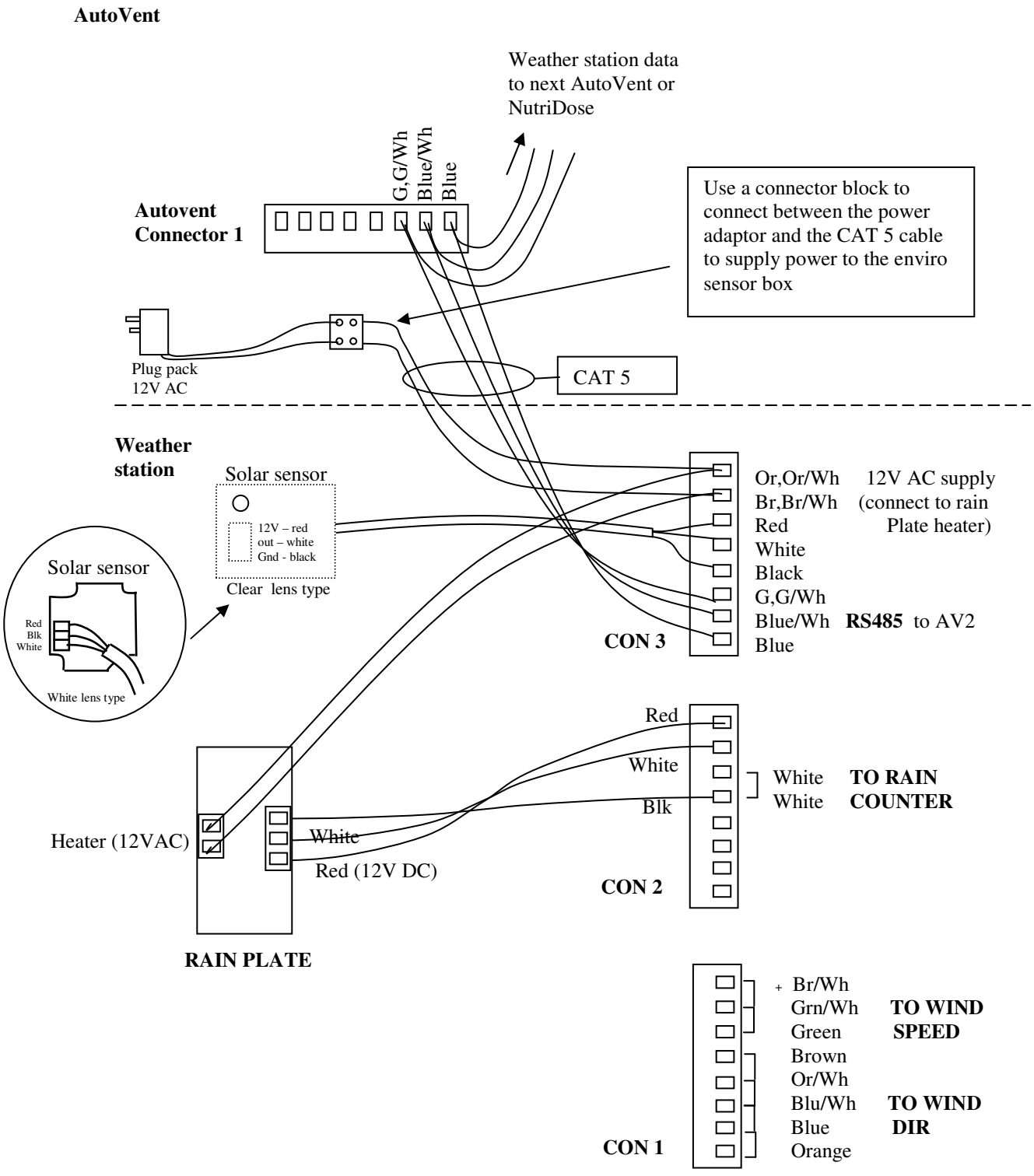


Connections for new style Enviro Sensor

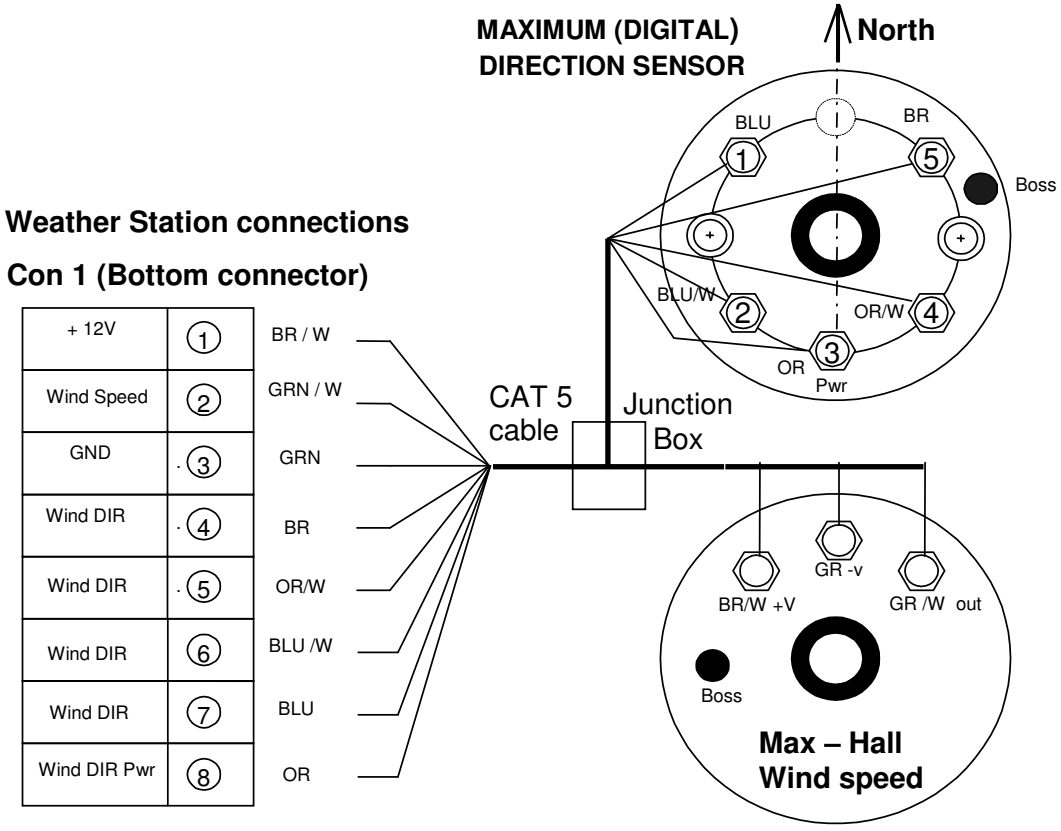
Bottom connector

Weather Station connections

The Weather Station broadcasts a report of the weather every three seconds to as many AutoVent and 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.

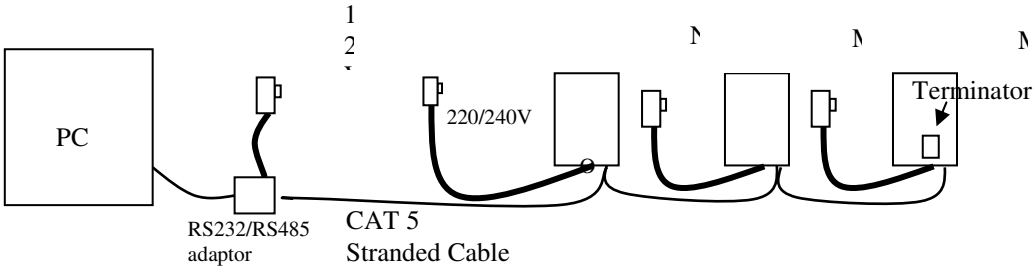


Connection of Wind Sensors

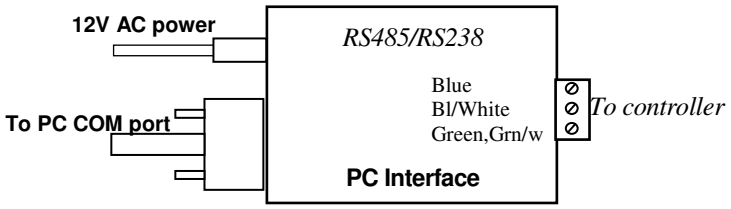


Connections to PC

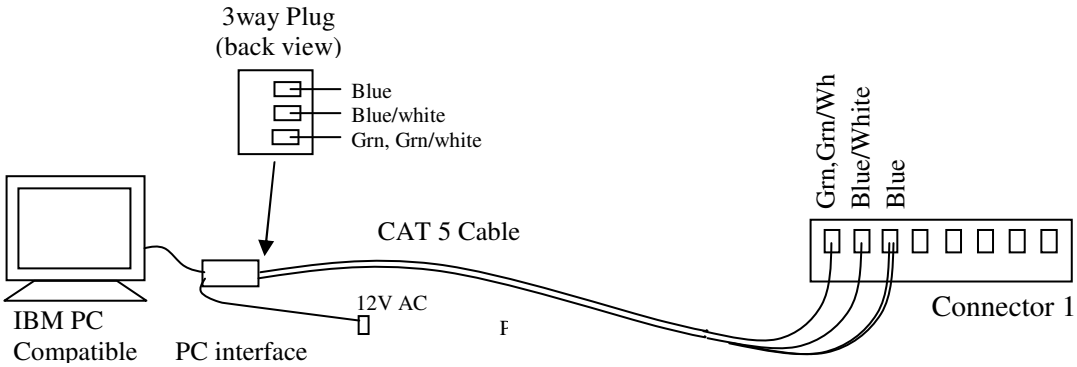
Use light coloured (so as not to attract heat) CAT5 stranded computer network cable between the PC interface and the AutoVent and/or monitors. This cable is "looped in" to each controller/monitor in a "daisy chain" fashion. The last monitor (and only the last monitor) in the chain must have a "terminator" fitted. Remember, when adding a further controller/monitor to remove the terminators from any monitor or controller 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 AV2 controller

Maintenance

Very little maintenance is required and will vary depending on the environmental conditions.
Periodically clean the air intake to the Weather Station and the environment sensor boxes. Check that the fans are running smoothly. Replace fans (12V DC ball bearing computer type)
Note that the fans supplied by Autogrow are specially dipped in varnish to make them more moisture resistant.
Check the humidity reading and if incorrect replace the electronic sensor. This sensor will need to be replaced every year or two and it is a simple matter to plug in a new sensor
Keep all controllers clean and dry and free from vermin and pests.

Trouble shooting

Venting

If the vents will not move when on manual or automatic and the indicator light does not come on then check the fuse as shown on the main circuit board in the "connections" section of this manual. If the light comes on but the vents do not move then the problem is most likely to be an overload circuit breaker tripped on the vent relay box.
If the vents move on manual but not on automatic or else move in small steps or do not fully open then check the timings and nudge size settings in the configuration tab.
If the greenhouse is hot but is found with the vents closed, check in the "events tab" to see why they closed – perhaps due to a strong wind or rain. Check the settings for wind and rain overrides

Heating

Proportional heating
If the heating does not come on when the greenhouse is cold, check the following:-
a) the heating set point and the measured temperature
b) the position of the modulating valve – if the valve is open then check why the boiler is not on.
c) try switching to manual, switching the heater on and turning the knob clockwise to open the modulating valve. Observe the valve to ensure it is working properly

ON/OFF heating
Switch to manual and observe if it operates. If it operates on manual then check settings and temperature reading to try to find out why it is not operating

CO_2

If the CO_2 is not injecting, check to ensure that the light level exceeds the setpoint, the vents are closed (below the maximum open position) and that CO_2 injection is enabled for this time zone. Check also the CO_2 reading and CO_2 set point.

Shading

If the shading is not operating, observe that it operates correctly on manual. If it does not operate and the light doesn't come on then check the fuse for this circuit (see main connection diagram). If the light does come on but the screen doesn't move then check if the overload in the relay box is tripped.

Warranty

The warranty on the controller, wind sensors, rain sensor, solar sensors 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 authorization .
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.