AutoVent 2

Operating Manual

Computerized Environmental Control System

- Four time zones to allow detailed environment profiling
- Advanced venting and heating algorithms
- Humidity control
- Suits most styles of greenhouse
- Shading
- Fogging
- Lighting (Option)
- Optional CO_2 injection
- Computer connection for Data Logging and Setting

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1. Overview

Features

- Suits most types of vented roof and/or side vented greenhouses.
- Heating – proportional or ON/OFF
- Advanced algorithm for venting and heating to give good control of temperature and humidity
- Fogging control - pulsed
- Stirring fan control
- Shade control
- Exhaust fan control (variable speed or ON/OFF)
- Four time zones to allow detailed profiling of environment
- Optional CO_2 injection
- Optional PC interface with remote setting, data logging, event logs etc

Venting

The AutoVent 2 can control the roof and side vents on most types of greenhouse including gull-wing, saw-tooth and 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.
The variable speed exhaust operates at a small (user settable) differential above the normal set point so that if the normal setpoint is not achieved the exhaust fans come on to assist.
The vents of gull-wing or Venlo style houses operate taking into account the wind from each side. Wind approaching from an angle to a vent is factored so that only the component at right angles to the vent is taken into account. When wind speed increases the windward vent will close first followed by the leeward vent. In the case of saw-tooth roofs, the leading vent (vent 1) will close first followed by the intermediate vents (vent 2).

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 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.

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 open he vents to try to open the vents to allow excess humidity to escape or close them 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 "cyclic purge" which can be enabled by the grower to crack the vents periodically whenever they are closed. 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 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. Two outputs are used; one that comes on constantly while three puffs of fog are emitted and a second that pulses on for short periods to inject the puffs of fog. This function may also be used with high or low pressure fogging systems. After each three puffs of fog, there is a fixed 5 minute detent before it can fog again.

Stirring fans

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

Shading

Shading is available only in houses having less than two side wall vents. (Output S2 is used). It operates to maintain the light level below a user set maximum. If the maximum light level is exceeded it will start to close immediately, but once closed requires the light to remain below the set point for at least the time specified by the user.

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.

Optional Lighting

By adding a low cost output expander module, up to three banks or lights may be added. Dividing the lighting into separate banks provides a number of different possibilities:-

- even if all lights have the same function, the start up power surge can be evened out by starting the banks one-after-the-other
- each bank may be used for a different purpose and may contain different types of lights
- if the light banks are interspersed then by inhibiting one bank at certain times, the power consumption can be managed
- banks may be used for more than one purpose

Each bank may be separately and independently assigned to one (or more) of three functions

1) supplemental lighting
2) photosynthesis top-up
3) photoperiod manipulation – day-length extension

Taking each of these in turn.

1) Supplemental. In this case, whenever the measured solar energy falls below a user set level for more than the user set time the lights assigned to this function will turn on. When the measured solar energy rises above a user set level the lights will switch off again. In all cases the minimum on/and off times for the lamps will be observed. In addition, if multiple banks

are assigned to the same function then there will be a fixed delay of 5 minutes between each bank switching on.

2) Accumulated solar top-up is provided to ensure that the crop has sufficient photosynthetic light each day for adequate growth. If the, user set, integrated PPFD is not reached by the end of each day then the lights are switched on for a time calculated to provide the necessary top-up. The desired integrated daily totals are entered into a table on the PC and every week the next value is automatically downloaded to the controller (on Saturday night at midnight). If the PC is not on-line at this time then it will be downloaded as soon as the PC is reconnected. The week numbers on the table are usually set by the grower to represent growing week but may be set to represent calendar weeks if desired.

3) Photoperiod manipulation is use to extend the daylength. The required daylength for each week of the year is entered in table form on the PC. Again, this is downloaded every Saturday night. The actual daylength is measured by the solar sensor (the time that the light level is above the user set level) and then the controller calculates how long to switch the lights on to achieve this.

PC interface

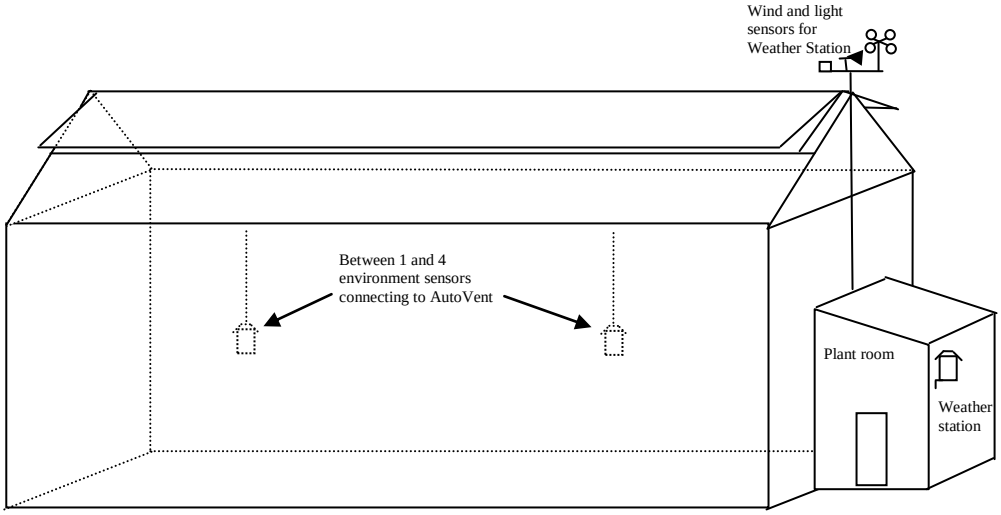
The optional PC interface allows the settings to be viewed and set from the user-friendly CompuGrow software. It also facilitates the collection of measured data and events from the controller for logging to the hard drive whence it may be displayed graphically for ease of interpretation. The computer 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).

VERY IMPORTANT

Manual override switches

When using the front panel switches, it is very important to always allow the vent and shade motors to fully stop before reversing direction. Some motors may take a few seconds to fully stop. If this is not done then it is possible for the motor to continue in the same direction in which case it will not stop when it contracts the limit switches.

2. 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 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 allow 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.

3. Settings

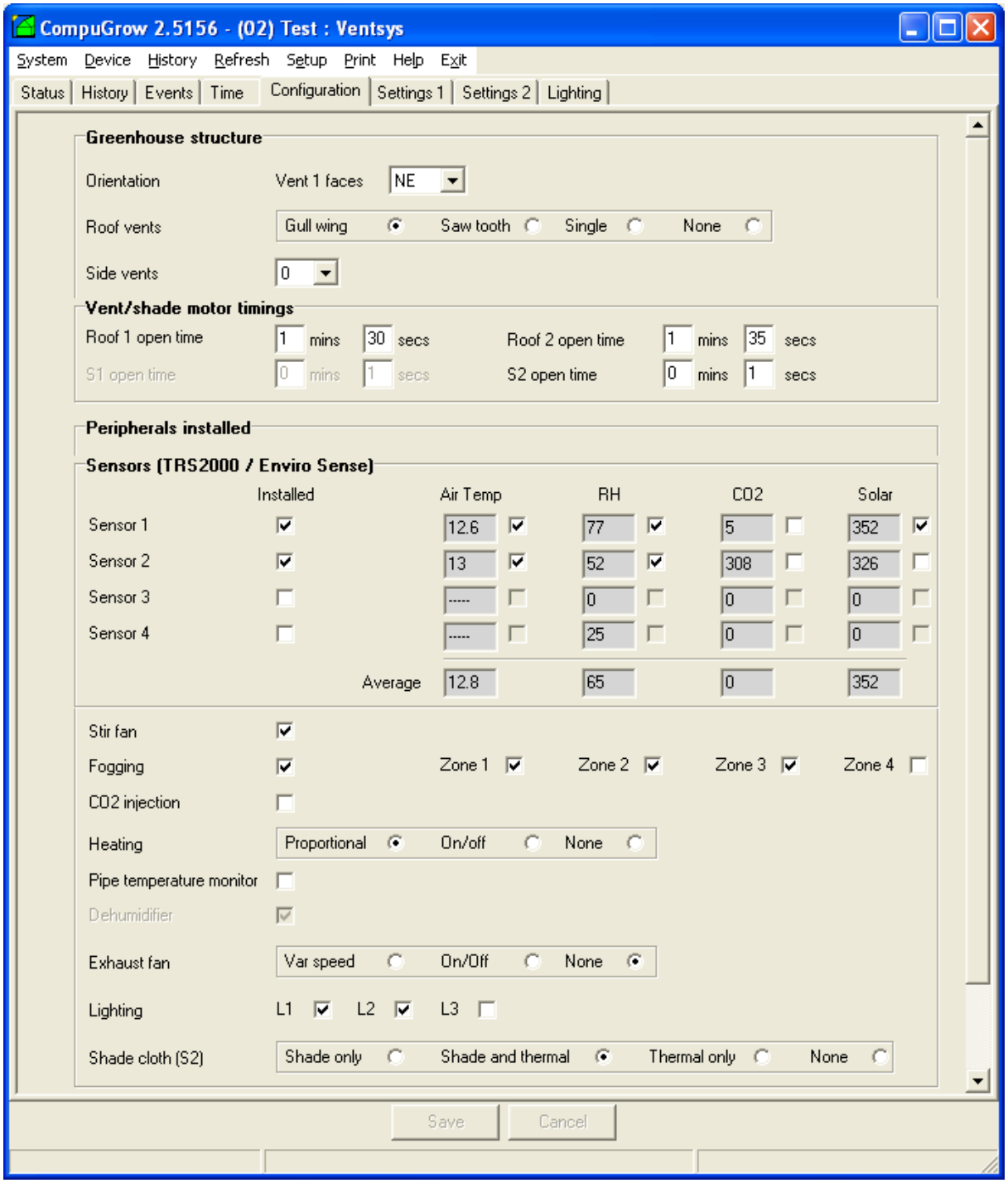
Introduction

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

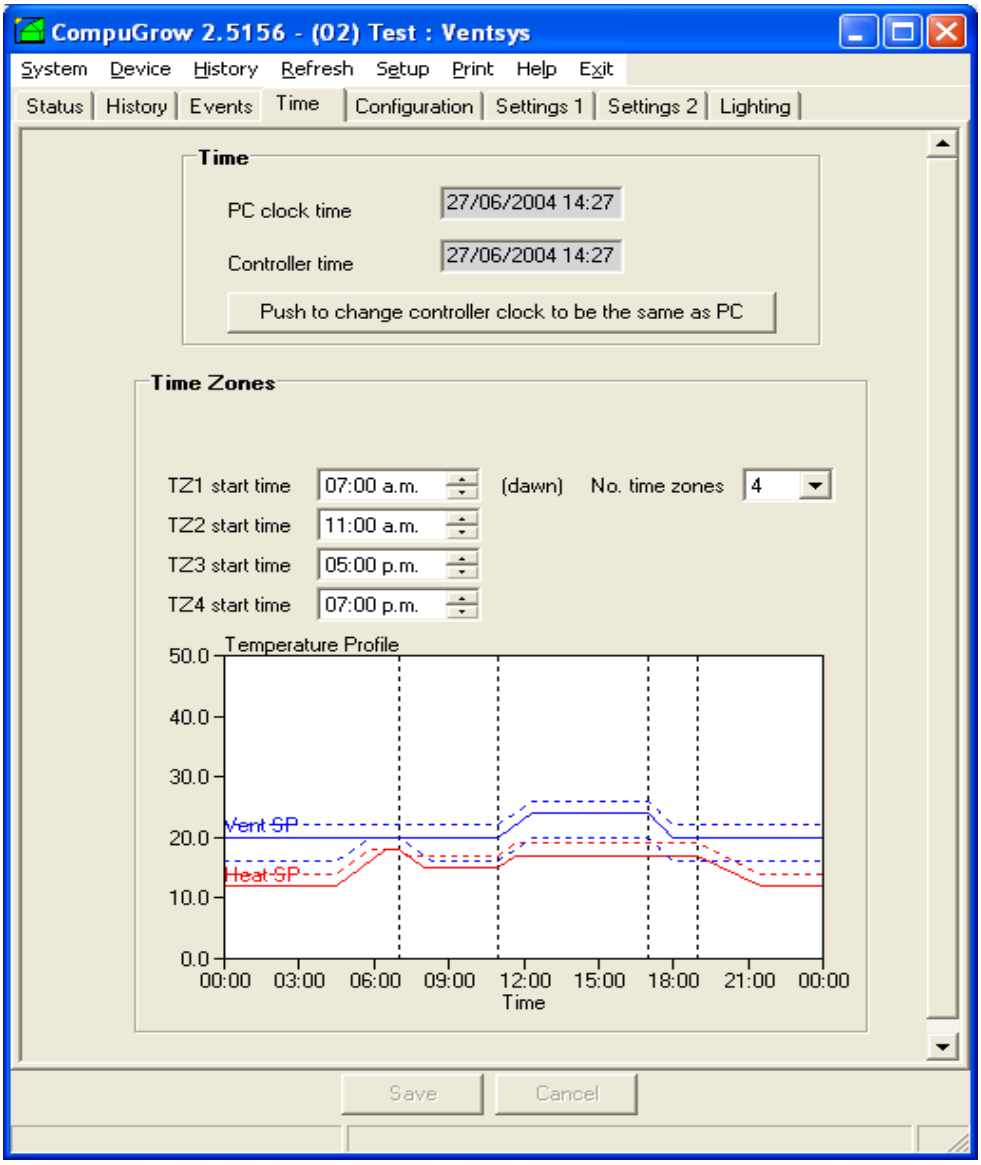
Refer to the CompuGrow software manual for instructions to establish communications between the PC and the AutoVent controller and once this has been established proceed as follows:-
We will work through the settings in the order that is most likely to be followed in practice.

Configuration tab



The configuration tab is used to specify details about the installed equipment. Here you select the type of greenhouse, which way vent 1 faces (normally choose the roof vent on the east side for vent one). In the case of saw-tooth houses vent 1 represents the leading vent and vent 2 represents the remining "intermediate" vents. 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 and then tick each parameter 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.

Time tab

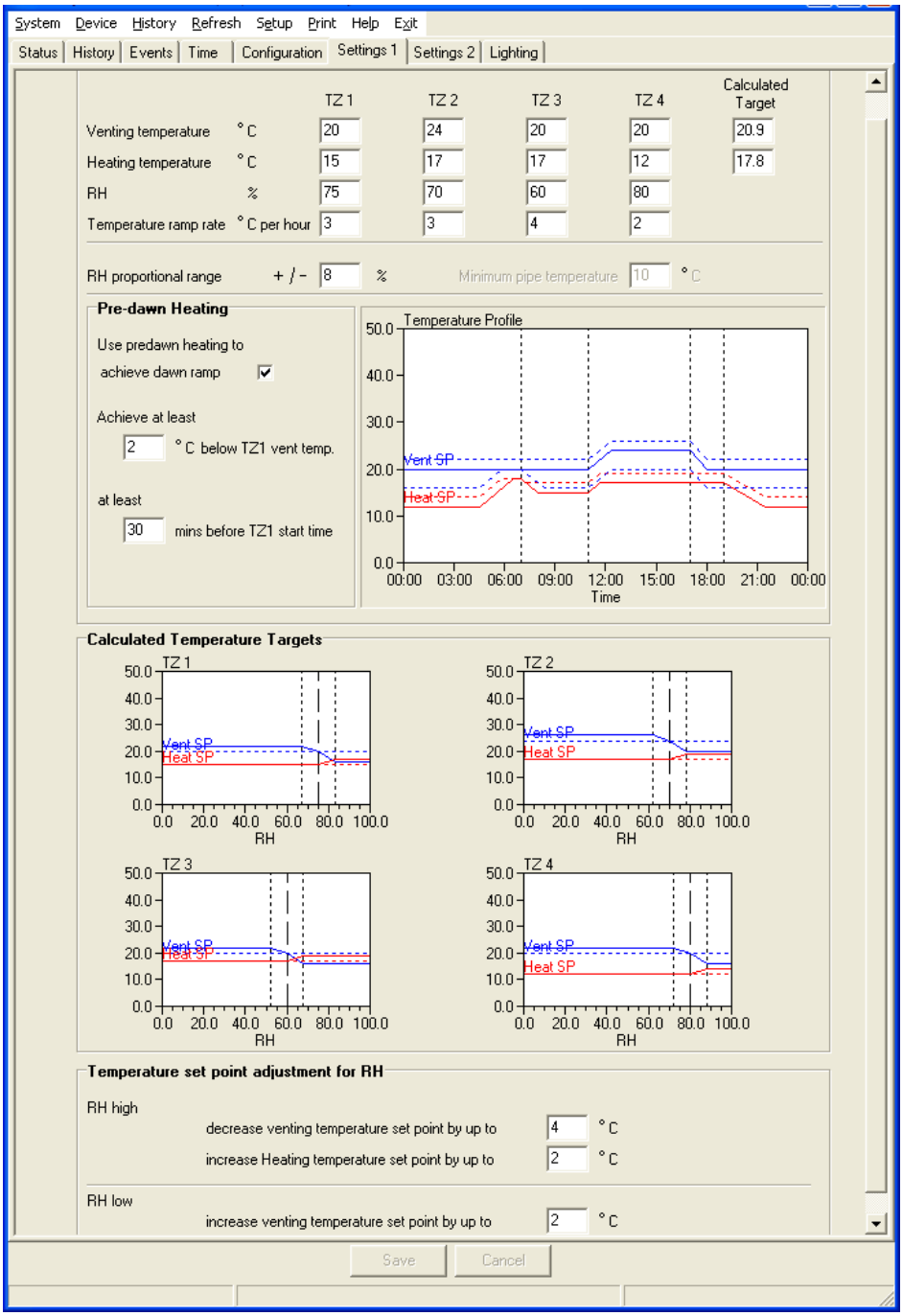


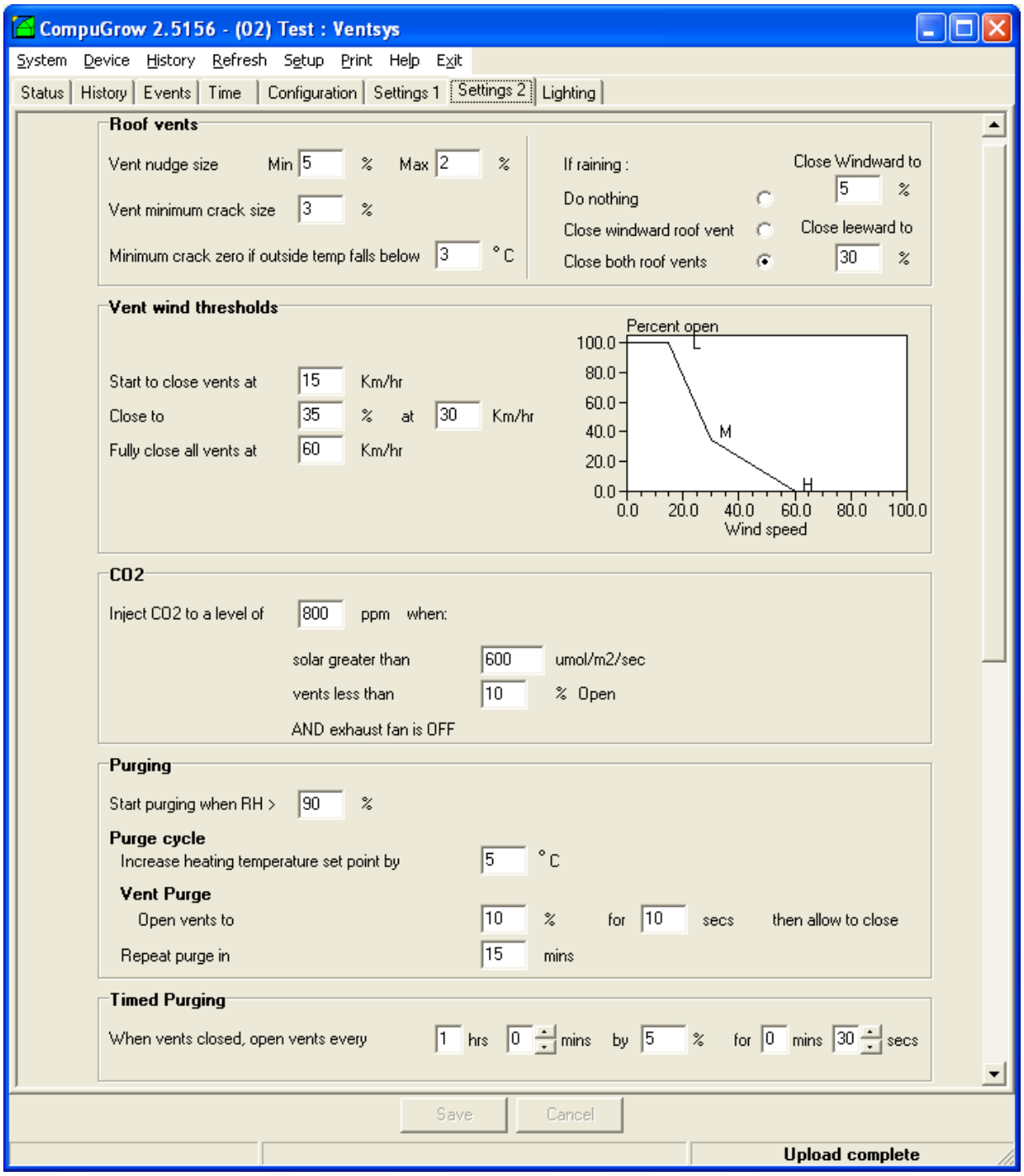
The time tab is used to set the controller clock (by making it the same as the PC clock). Of course, it is a good idea to correct the PC clock and calendar before setting this. You also need to specify the start time for each time zone. Note that time zone one must start at dawn if pre-dawn heating is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

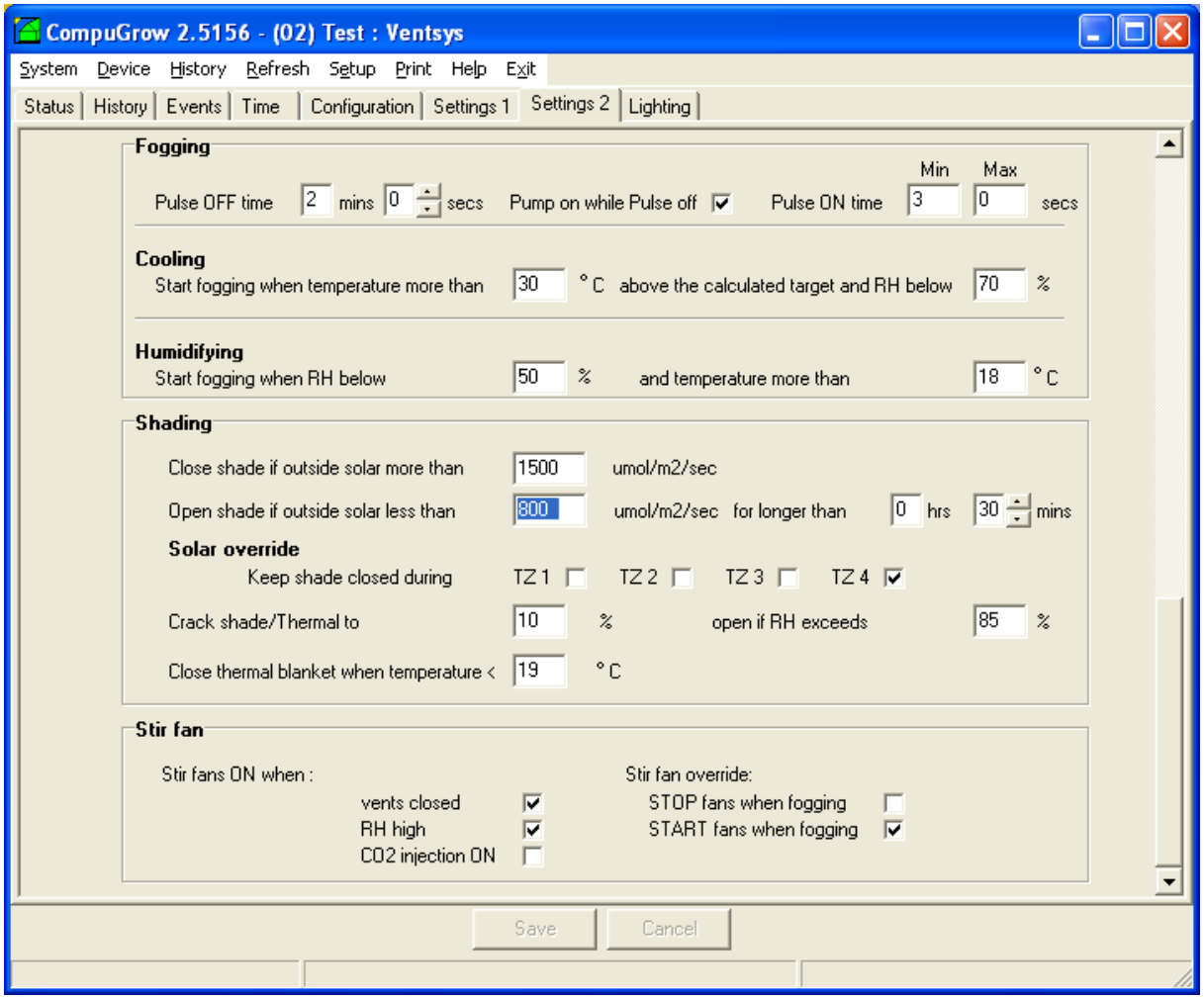
Settings 2 tab



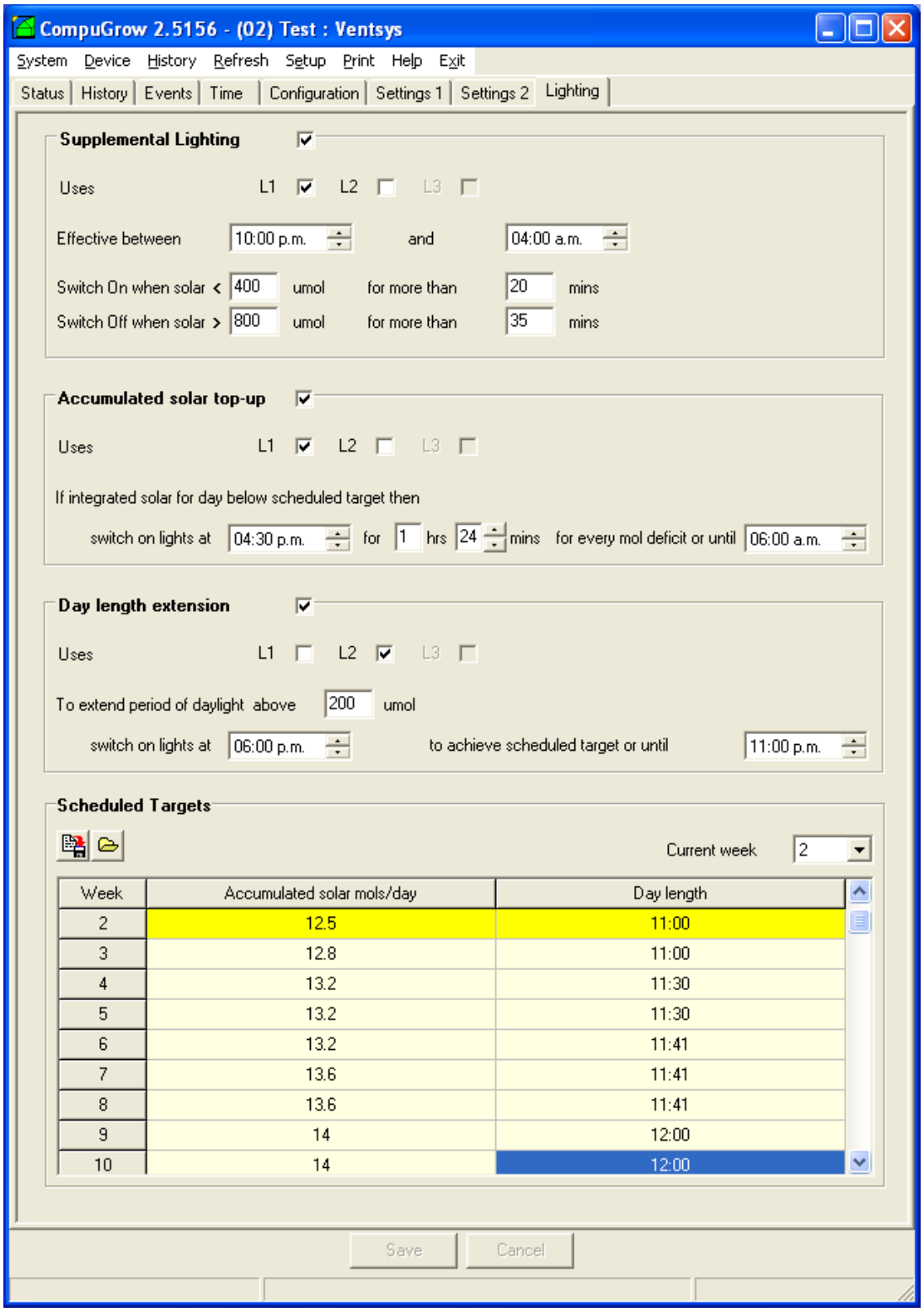


The second settings tab holds a range of less frequently changed settings.
The first group is concerned with vent nudge sizes. The controller will calculate the most appropriate vent nudge size within the range specified, based on outside temperature, wind speed, current vent position, etc. Normally 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.
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 has been reached.

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 may be set so that if the RH exceeds the set point then the heating set point will be raised and periodically the vents will nudge open for a short time. The idea is to expel the humid air and then warm and dry the fresh air which replaces it.
Other settings on this tab control the fogging, shading, stirring and exhaust fans.

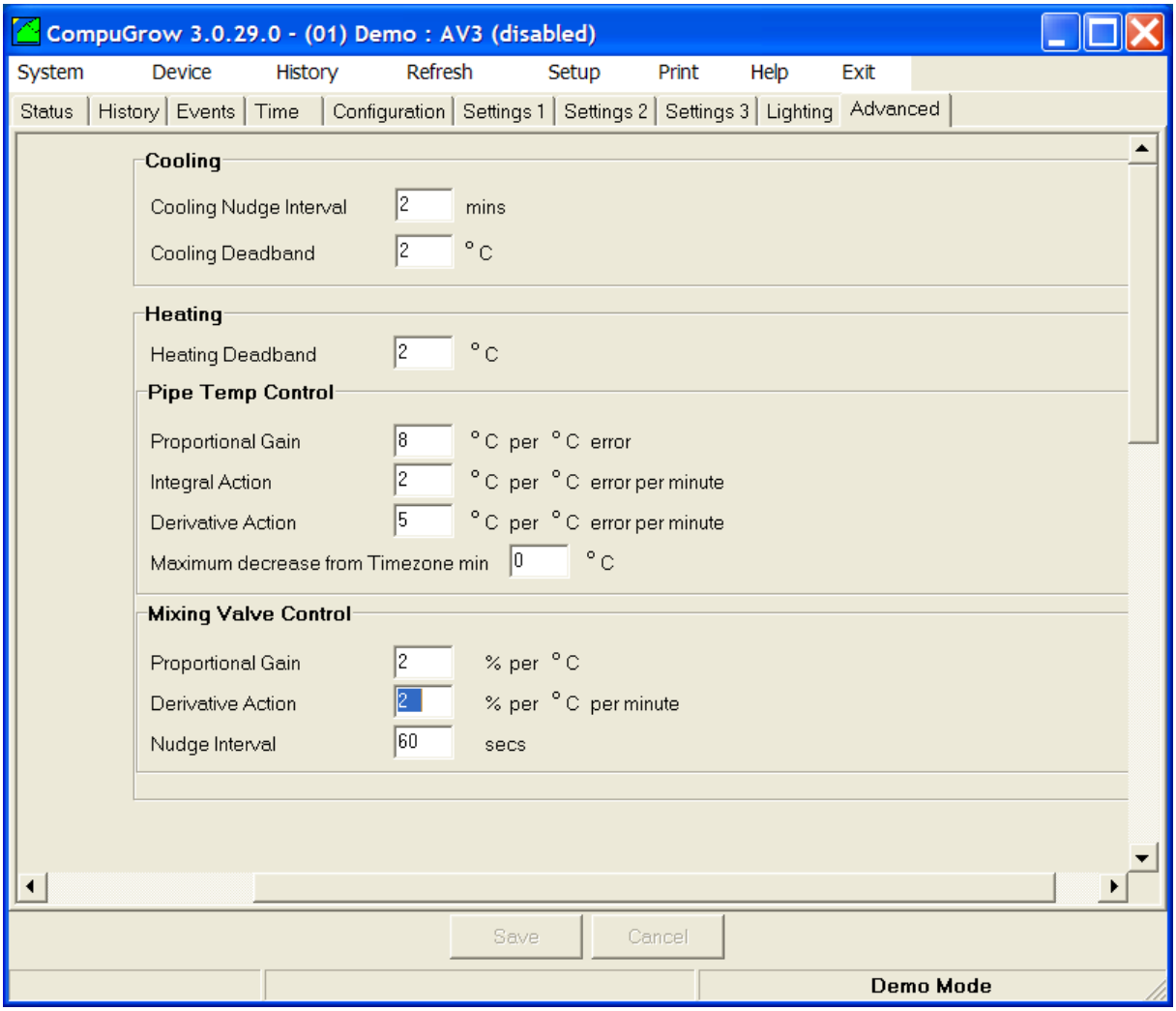


Lighting tab



The lighting settings are reasonably simple.
Each required function must be enabled and then one (or more) of the three possible light banks assigned to it by putting a “check” in the appropriate boxes. Then the “rules” for switching the lights on/off are completed. This involves setting the times for the lights to come on or the period during which the rule is active and also setting the light levels etc.

In the Accumulated solar top-up section it should be noted that the daylength is measured as the time that the light level was above the minimum value represented in the rule " To extend period of daylight above xxxx umols.
If "accumulated top-up" or "day-length extension" are required, the 52 week schedule at the bottom must be completed. Notice the two symbols at the top left of the schedule are for storing the schedule to disk and for restoring it.



Guidelines for heating settings on AV2, AV2t and AV3

General information

If a pipe temperature (T2K) sensor is installed then the heating control is broken into two control loops. The first "slow" loop measures the air temperature and uses this to set the "pipe temperature". The second "fast" acting loop, takes the measured pipe temperature and uses this to position the 3 way mixing valve. Both loops are PID loops. The fast valve loop uses simple nudges to implement the I term so the settings are for the P and D parts only.

For the slow loop
P – the proportional term is the multiplier that is applied to the measured error to generate some output. So, it the measured error is say 3C below the target temperature and the proportional term is

set to 10degC per degC error then the pipe temperature will instantly be set to 3x10 =30°C above the calculated air target temp.
So if the calculated air temp was 24°C then with a -3°C error the pipe temp would immediately go to 54°C. The proportion term provides a quick adjustment but it not very accurate as it depends on there being an error in order to produce some output. Setting the proportional gain high will reduce this error but will also increase the tendency to overshoot/undershoot. If set much too high the system will oscillate wildly. We suggest an initial setting of 8°C per ^{o}C error

I – Intergral term is used to gradually eliminate the proportional error. It will gradually nudge the pipe temperature toward the optimum position until there si no error left. At this point it will have taken over completely from the proportional term which now produces zero output as there is zero error. Setting the integral time too short will lead to "integral wind-up" which will also cause instability. This happens when the integral action happens faster than the normal response of the greenhouse temperature. We suggest an initial setting for integral time of 2°C per ^{o}C per minute.

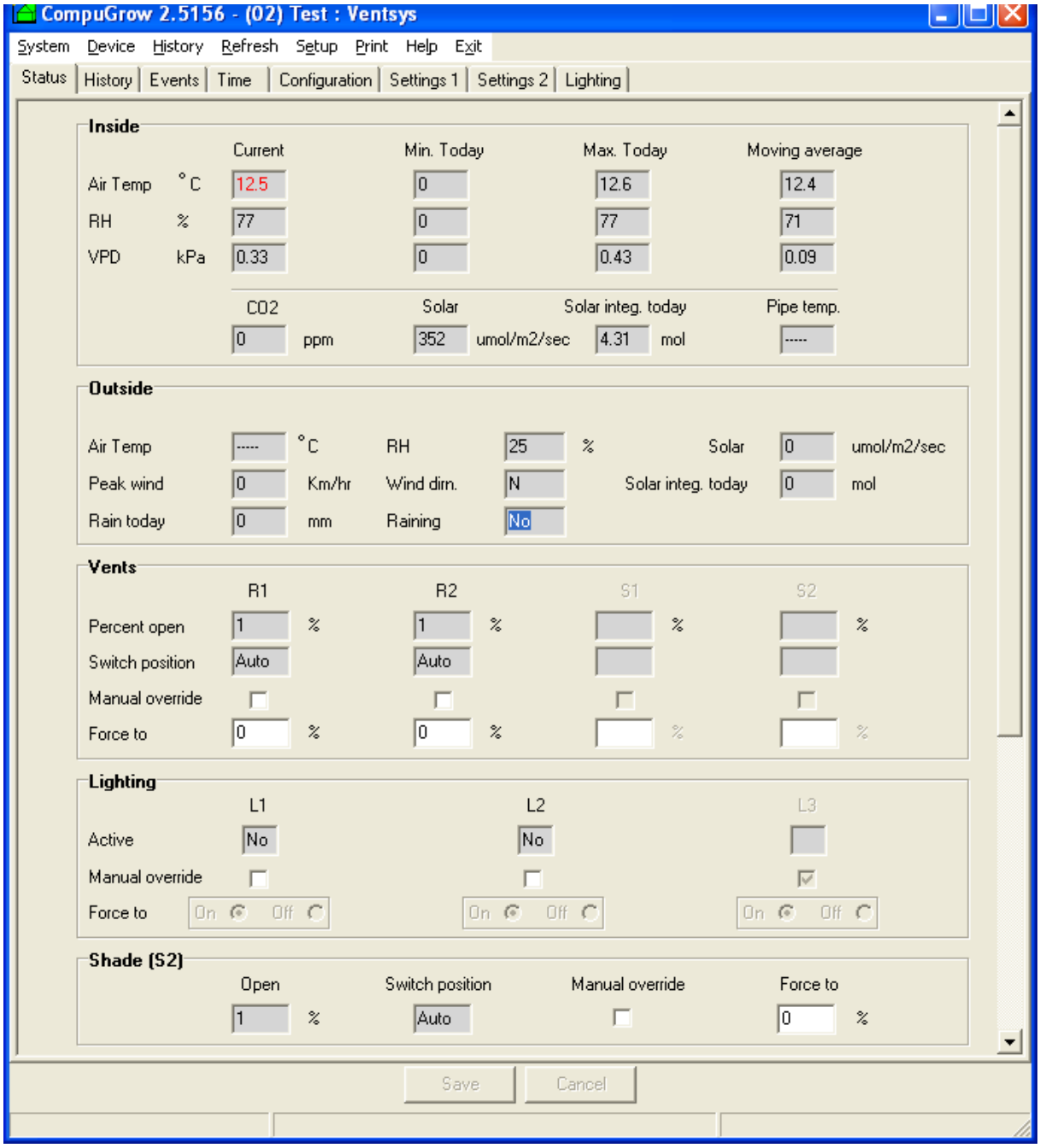
D – derivative term is used to avoid overshoot. It looks at how quickly the temperature is changing and uses this to modify the heating effort. For instance, imagine that the heating has come on when the temperature is 5°C low. The pipe temp will be set on high and soon the temperature starts to rise in the greenhouse. If this is rising at say 1deg every minute then it is likely that the temperature will soon overshoot the target. However, if the D term is set to say 5 then the pipe temperature will be reduced by 5°C below what the P and I terms are calling for. Suggested starting setting 5. Make this higher if response is fast and system overshoots.

Setting the slow loop
Start with the suggested start settings of P =8, I = 2, D = 5.
If system is very sluggish increase P gradually. If quickly moving the valve in the desired direction it is slow to eliminate the residual error decrease the I term a little but be careful as it could make the system unstable if a large step input occurred. Ie the boiler started late because it was out of fuel and so it is starting with a very large error.
If the system seems to easily overshoot even though it is not overly fast to respond try increasing the D term.
Setting the fast Loop
The fast loop has similar considerations but has the integral time is replaced by the nudge interval.

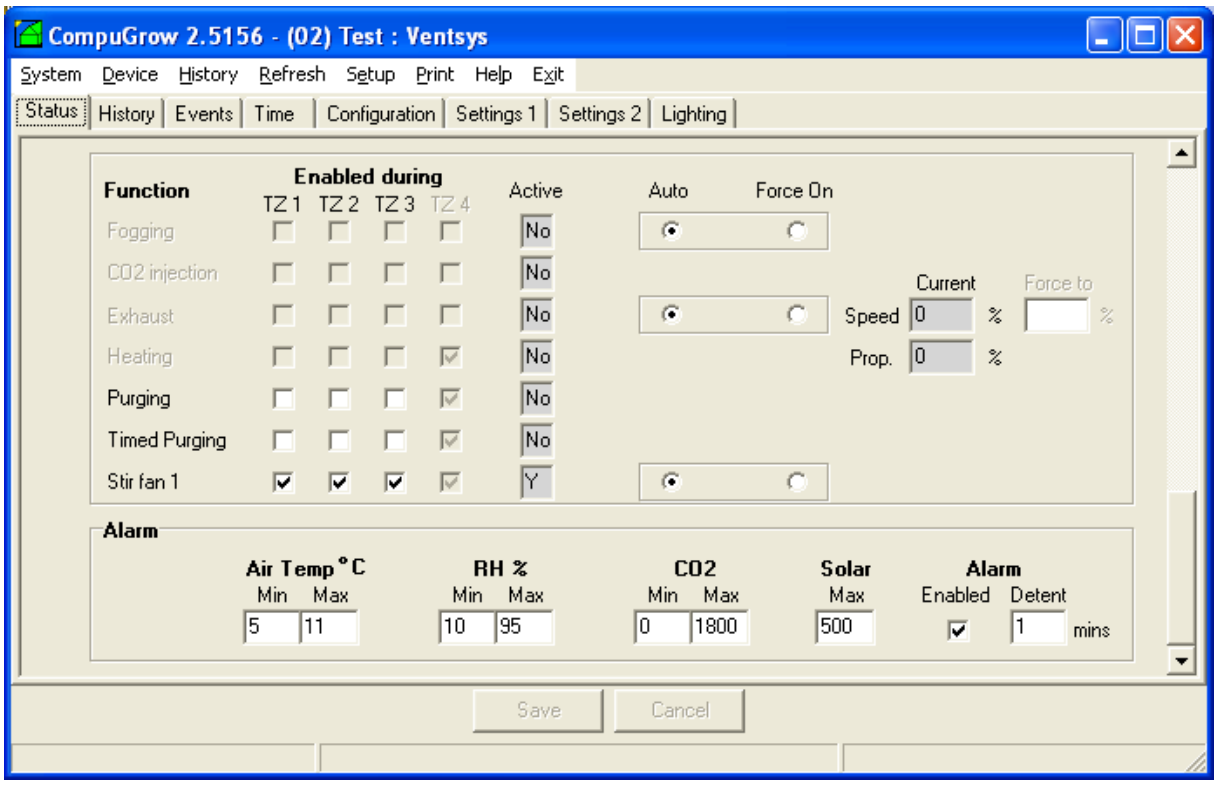
Start with settings P=2.0, D=1, Nudge interval 60 seconds.

With P set to 2, an pipe temp error of 10°C will cause a proportional nudge of 20%. After a wait of 60 seconds the temperature will be compared again and if still in error a further nudge will be applied. Note that nudge sizes are limited to between 2% and 30%. If the valve overshoot frequently then reduce the P gain setting and increase the nudge interval. Also try increasing the D setting.

status tab



The status tab shows the current readings and status of the environment both inside and outside the greenhouse. It also shows the current vent positions and allows you to force them to move to a specified percentage open. It also allows you to see if other functions are currently active and it will allow you to disable or force some functions to become active.



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

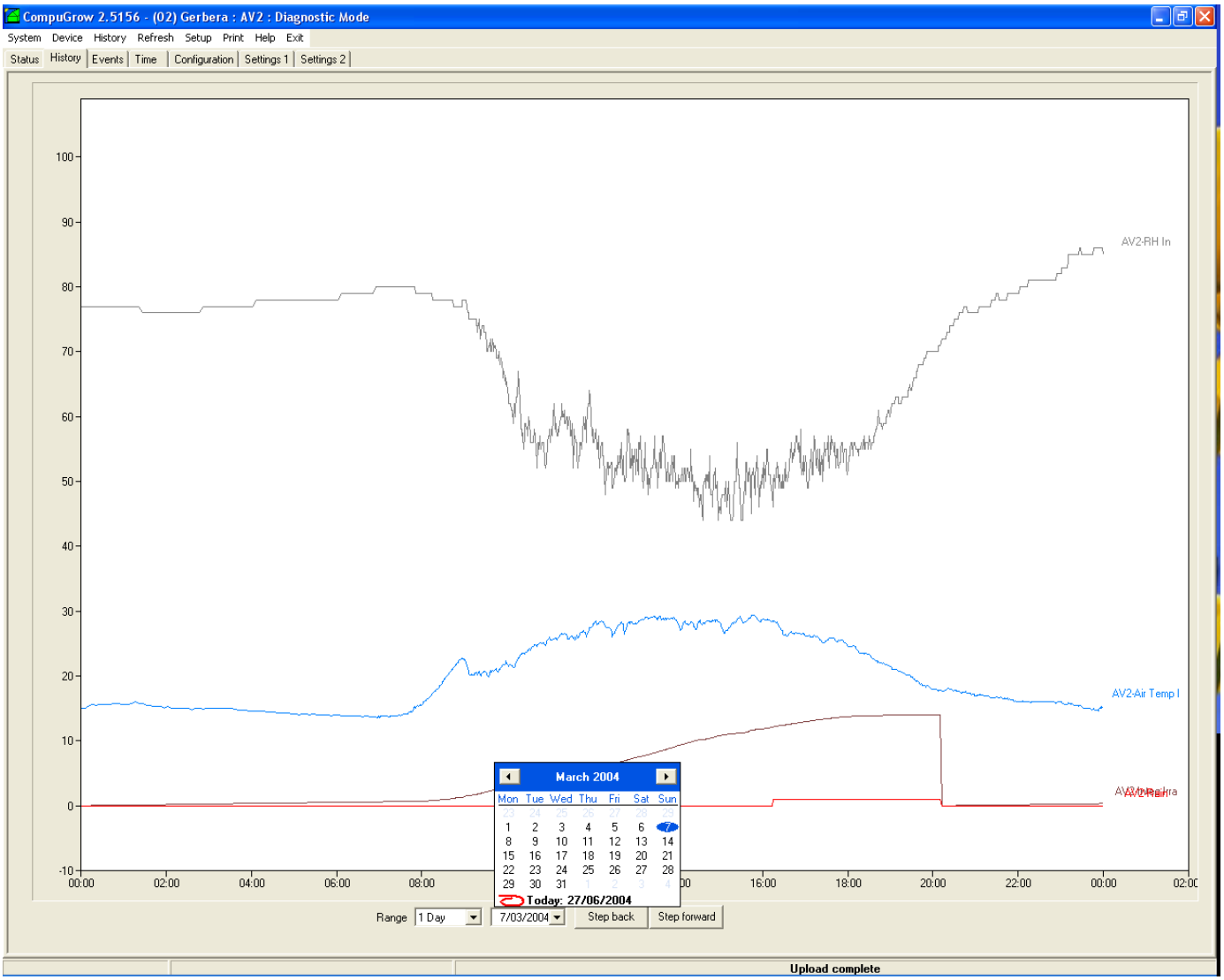
From the history tab, you can select History View on the main menu bar and can then switch on/off all variables and change the graph colours to obtain the view you require

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.

History tab

This allows you to view readings for any period from 5 minutes to 1 week for any date since you started collecting records. The parameters viewed are easily selected as are the colours of the graphs.



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. Note that the lighting schedule is stored and retrieved separately using the buttons just beneath the schedule in the lighting tab.

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

- Environment
- Weather
- Output Status
- TimeZone Settings
- Time / Date
- Alarms
- Overrides
- Setup

ENVIRONMENT

ENVIR Readings1 →
```
ENVIR Readings1
AirTemp : xxx.x°C
Solar   : xxxxum
RH : xxx% CO2: xxxx
```

ENVIR Readings2 →
```
ENVIR Readings2
VPD      : xx.x
Intg Sun : xxx.xx
PipeTemp : xxx.x°C
```

ENVIR Calc Setpoints →
```
ENVIR Calc Setpoints

Venting SP: xxx.x°C
Heating SP: xxx.x°C
```

ENVIR Enviro Units →
```
ENV Readings Unit1
ENV Readings Unit2
ENV Readings Unit3
ENV Readings Unit4
```
→
```
ENV Readings Unitx
AirTemp : xxx.x°C
Solar   : xxxxum
RH : xxx% CO2: xxxx
```

ENVIR Day Ave Report →
```
ENVIR Day Ave Report
Ave Temp : xxx.x°C
Ave RH   : xxx%
Ave VPD  : xx.x
```

ENVIR Min/Max Report →
```
ENVIR Min/Max Report
    Temp   RH  VPD
Min: xxx.x xxx xx.x
Max: xxx.x xxx xx.x
```

ENVIR Calibrate →
```
ENV Calibrate ENV1
ENV Calibrate ENV2
ENV Calibrate ENV3
ENV Calibrate ENV4
```
→ ENVx Calib RH/Solar →
```
ENVx Calib RH/Solar
      RH   Solar
Calib :    %      um
Raw   :    %      um
```
→ ENVx Calib Temp/CO2 →
```
ENVx Calib Temp/CO2
      Temp    CO2
Calib: xxx.x°C  xxxx
Raw  : xxx.x°C  xxxx
```

WEATHER

WEATHER Readings →
```
WEATHER Readings
Temp  : xxx.x°C
RH    : xxx%
Solar : xxxxum
```

WEATHER Wind →
```
WEATHER Wind

WindSpeed : xxxkm/hr
WindDir   : NNE
```

WEATHER Rain/Solar →
```
WEATHER Rain/Solar
Raining    : y
Rain Today : xxxmm
Intg Solar : xxx.xx
```

WEATHER Calibrate →
```
Calib RH/Solar
Calib Temp/CO2
```

OUTPUT STATUS

OUTPUT Vent/Shade →
```
OUTPUT Vent/Shade

R1 : xxx%  S1 : xxx%
R2 : xxx%  S2 : xxx%
```

OUTPUT Heat Status →
```
OUTPUT Heat Status

ON/OFF :
Prop   : xxx%
```

OUTPUT Extract/CO2 →
```
OUTPUT Extract/CO2
 Extract Fan
ON/OFF :        CO2
Prop   : xxx%
```

OUTPUT Fog/Stir →
```
OUTPUT Fog/Stir
Fog Pump  :
Fog Pulse :
Stir1     :
```

TIMEZONE SETTINGS

TZ General Setup →
```
TZ General Setup

  No of TimeZones
        X
```

TZ TimeZone1 Setup
TZ TimeZone2 Setup
TZ TimeZone3 Setup
TZ TimeZone4 Setup

TZx Start Time & RH →
```
TZx Start Time & RH

Start Time  : xx:xx
RH Setpoint : xxx%
```

TZx Temp Settings →
```
TZx Temp Settings
Venting SP : xxx.x°C
Heating SP : xxx.x°C
Ramp Rate  : xxx.x°C
```

TZx Setup Heat/Shade →
```
TZx Setup Fn Enable
Stir1:Y
Prge :Y  TimedPrg :Y
Fog  :Y       CO2 :Y
```

TZx Setup Fn Enable →
```
TZx Setup Heat/Shade

Enable Heating   : Y
Frc Shade Closed : Y
```

TIME AND DATE

```
TIME Time / Date

  xx:xx:xx  (Time)
  xx/xx/xx  (Date)
```

ALARMS

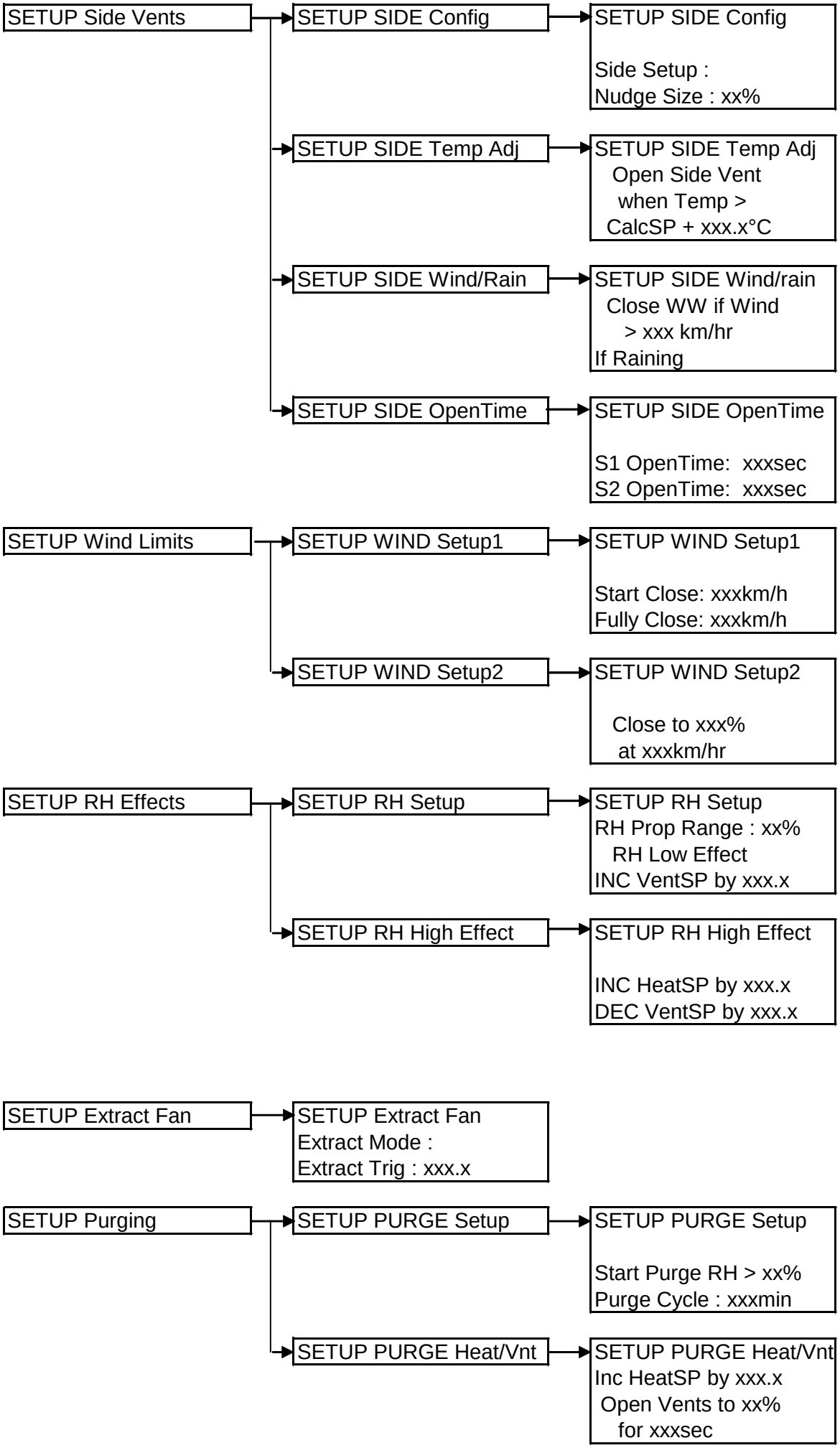
```
ALARMS Setup  ──►  ALARMS Setup
                   Alarm Enabled : Y
                   Alrm Detent: xx.xmin

ALARMS Settings ──► ALARMS Settings
                       ATemp  RH   CO2
                   Min:  xxx  xxx% xxx0
                   Max:  xxx  xxx% xxx0
```

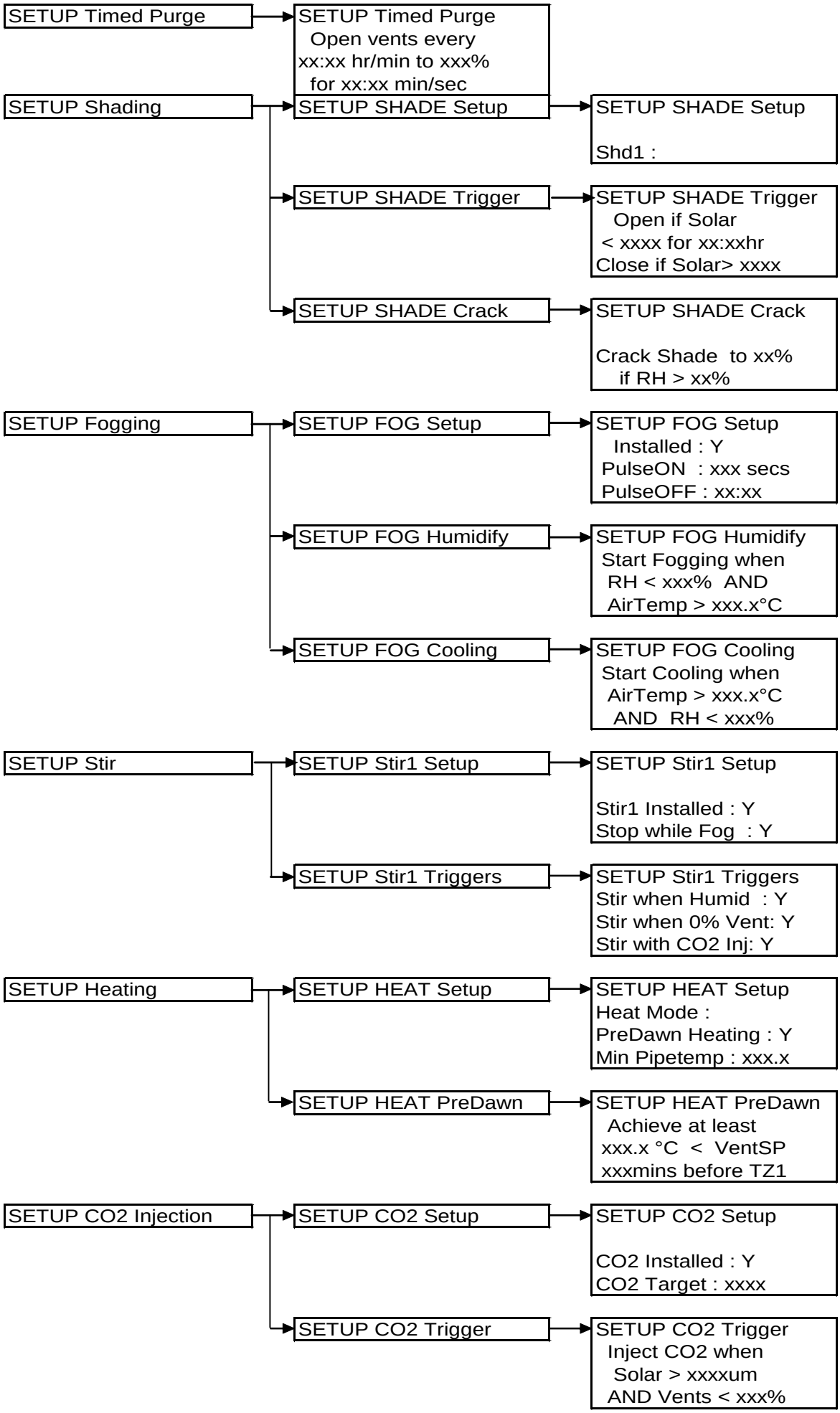
OVERRIDES

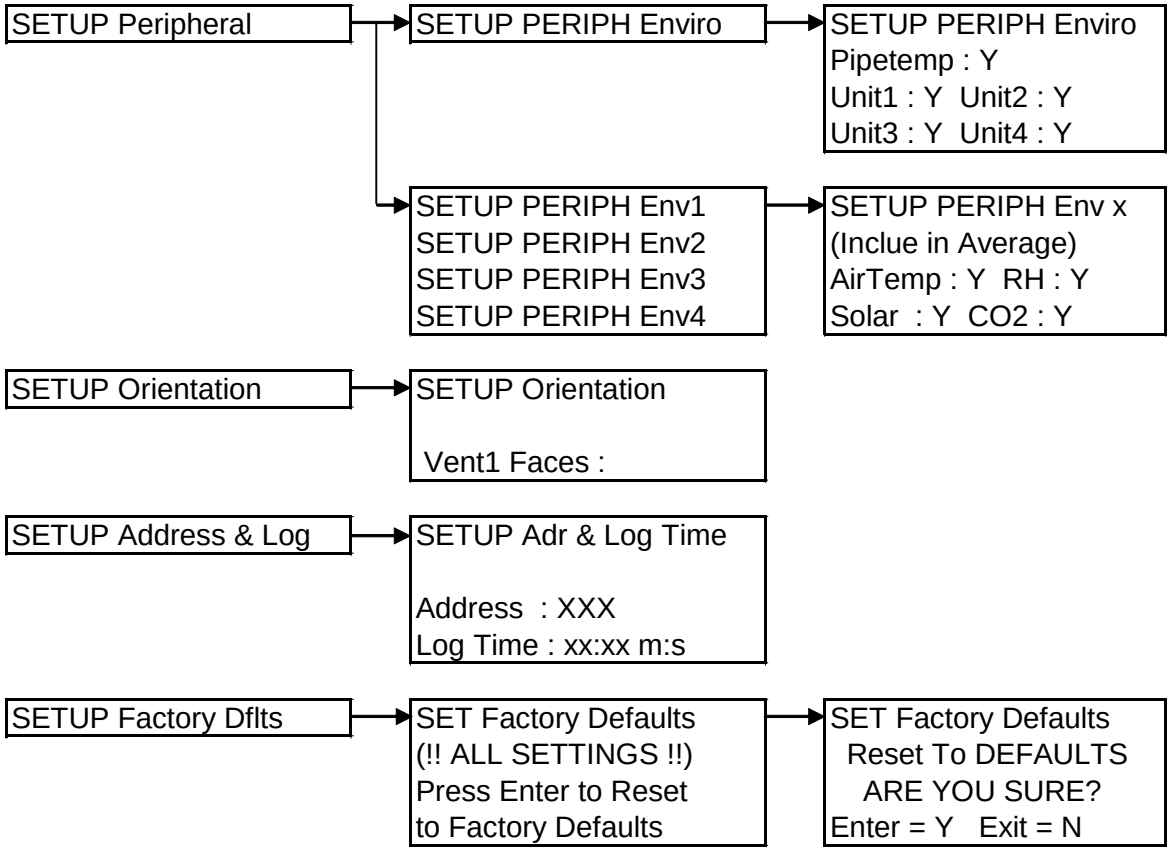
```
OVERRIDE Roof Vent ──► OVERRIDE Roof Vents
                          R1     R2
                       Mode  :
                       Force : xxx%   xxx%

OVERRIDE Side Vent ──► OVERRIDE Side Vents
                          S1     S2
                       Mode  :
                       Force : xxx%   xxx%

OVERRIDE Extract ──► OVERRIDE Extract

                     Mode  :
                     Force : xxx%

OVERRIDE Fog/Stir ──► OVERRIDE Fog/Stir
                      Fog Mode   :
                      Stir1 Mode :
```

SETUP

```
SETUP Roof Vents ──► SETUP ROOF Config ──► SETUP ROOF Config
                                            Setup :
                                            If Raining
                                            WW: xxx%   LW: xxx%
                 ──► SETUP ROOF Nudge ──► SETUP ROOF Nudge

                                            Min Nudge Size : xx%
                                            Max Nudge Size : xx%
                 ──► SETUP ROOF Crack ──► SETUP ROOF Crack

                                            Minimum Crack : xx%
                                            Zero Crack : xxx.x°C
                 ──► SETUP ROOF OpenTime ──► SETUP ROOF OpenTime

                                            R1 OpenTime:  xxxsec
                                            R2 OpenTime:  xxxsec
```


SETUP Side Vents
SETUP SIDE Config
SETUP SIDE Config
Side Setup :
Nudge Size : xx%
SETUP SIDE Temp Adj
SETUP SIDE Temp Adj
Open Side Vent
when Temp >
CalcSP + xxx.x°C
SETUP SIDE Wind/Rain
SETUP SIDE Wind/rain
Close WW if Wind
> xxx km/hr
If Raining
SETUP SIDE OpenTime
SETUP SIDE OpenTime
S1 OpenTime: xxxsec
S2 OpenTime: xxxsec
SETUP Wind Limits
SETUP WIND Setup1
SETUP WIND Setup1
Start Close: xxxkm/h
Fully Close: xxxkm/h
SETUP WIND Setup2
SETUP WIND Setup2
Close to xxx%
at xxxkm/hr
SETUP RH Effects
SETUP RH Setup
SETUP RH Setup
RH Prop Range : xx%
RH Low Effect
INC VentSP by xxx.x
SETUP RH High Effect
SETUP RH High Effect
INC HeatSP by xxx.x
DEC VentSP by xxx.x
SETUP Extract Fan
SETUP Extract Fan
Extract Mode :
Extract Trig : xxx.x
SETUP Purging
SETUP PURGE Setup
SETUP PURGE Setup
Start Purge RH > xx%
Purge Cycle : xxxmin
SETUP PURGE Heat/Vnt
SETUP PURGE Heat/Vnt
Inc HeatSP by xxx.x
Open Vents to xx%
for xxxsec


SETUP Timed Purge
SETUP Timed Purge
Open vents every
xx:xx hr/min to xxx%
for xx:xx min/sec
SETUP Shading
SETUP SHADE Setup
SETUP SHADE Setup
Shd1 :
SETUP SHADE Trigger
SETUP SHADE Trigger
Open if Solar
< xxxx for xx:xxhr
Close if Solar> xxxx
SETUP SHADE Crack
SETUP SHADE Crack
Crack Shade to xx%
if RH > xx%
SETUP Fogging
SETUP FOG Setup
SETUP FOG Setup
Installed : Y
PulseON : xxx secs
PulseOFF : xx:xx
SETUP FOG Humidify
SETUP FOG Humidify
Start Fogging when
RH < xxx% AND
AirTemp > xxx.x°C
SETUP FOG Cooling
SETUP FOG Cooling
Start Cooling when
AirTemp > xxx.x°C
AND RH < xxx%
SETUP Stir
SETUP Stir1 Setup
SETUP Stir1 Setup
Stir1 Installed : Y
Stop while Fog : Y
SETUP Stir1 Triggers
SETUP Stir1 Triggers
Stir when Humid : Y
Stir when 0% Vent: Y
Stir with CO2 Inj: Y
SETUP Heating
SETUP HEAT Setup
SETUP HEAT Setup
Heat Mode :
PreDawn Heating : Y
Min Pipetemp : xxx.x
SETUP HEAT PreDawn
SETUP HEAT PreDawn
Achieve at least
xxx.x °C < VentSP
xxxmins before TZ1
SETUP CO2 Injection
SETUP CO2 Setup
SETUP CO2 Setup
CO2 Installed : Y
CO2 Target : xxxx
SETUP CO2 Trigger
SETUP CO2 Trigger
Inject CO2 when
Solar > xxxxum
AND Vents < xxx%



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

Apogee light sensor - fit jumper A

RH Calibration
If the enviro sensor has a label attached marked " CALIB +/- xx% then you will need to ensure that the calibration is set to +/- xx% on the controller. For example, if the label states Calib -7% then go into the calibration screen on the controller <enviro\calib> and then adjust the calibrated reading until it is 7% less than the raw reading. If more than one enviro sensor is used then adjust the calibration to achieve the average of the calibration factors for each enviro sensor.

Installing the optional output expander(s)

The optional output expander(s) provide addition outputs required for the options:- Fogging (pump plus 4 zones) and three light banks.

The first expander (to provide the above options) must have its address set with four switches on the internal dip to be switched to the ON position. If a second expander is fitted to provide optional lighting control then it should have switches 1,2&3 switched ON and switch 4 OFF.

First output expander outputs

Z1	Fog pump
Z2	Fog zone 1
Z3	Fog zone 2
Z4	Fog zone 3
Z5	Fog zone 4
Z6	Fog zone 5

Z7 Fog zone 6
Z8 Light bank 1
Z9 Light bank 2
Z10 Light bank 3

Installing the Weather Station

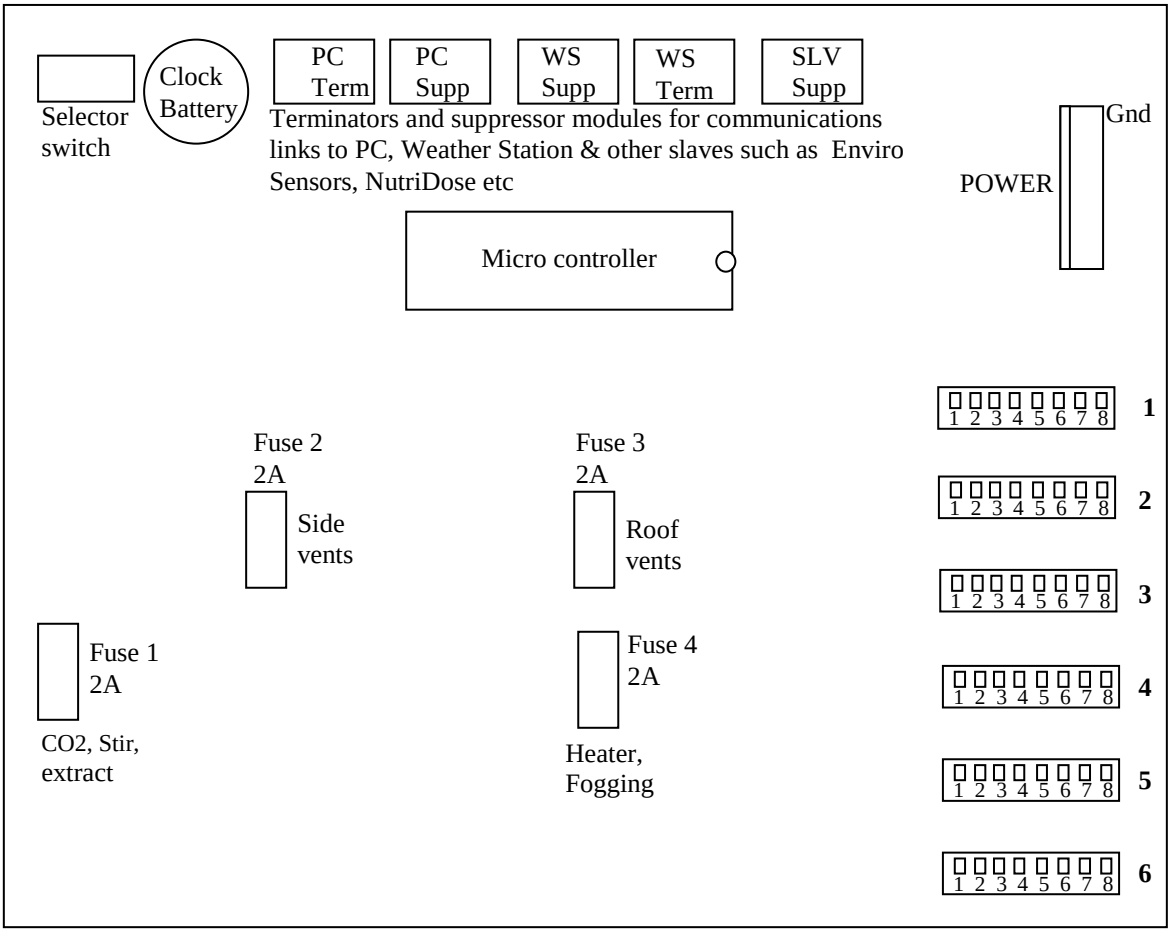
The wind gear should be installed about 1.5m above the apex of the greenhouse. If the Weather Station is to provide data to more than one AutoVent then it should be installed on a greenhouse at the end of the row, preferably in a position that has maximum exposure to any strong prevailing winds.
The 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.
Fit rain sensors on an angle of about 20 to 40 degrees (with cable entry at lowest end) so that rain drops tend to run off the sensor.
Fit solar light sensors horizontally. Do **not** tilt toward the sun. For best accuracy, use a spirit level
Adjust the RH calibration in the same way as done for the enviro sensors.

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 standard 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.

4. Connection Diagrams

AutoVent connections



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 going to 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.

Autovent 2 Connectors

POWER CONNECTOR

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

Connector 1

1	Grn,Grn/w
2	Blue/wh
3	Blue
4	nc
5	nc
6	Grn,Grn/w
7	Blue/wh
8	Blue

PC RS485

WS RS48

Connector 2

1	0-10V Heater
2	0-10V Exhaust
3	
4	
5	Common
6	Grn,Grn/wh
7	Blue/wh
8	Blue

ES, ND2 RS485

Connector 3

1	Roof 1 OPEN
2	Common
3	Roof 1 CLOSE
4	Common
5	Roof 2 OPEN
6	Common
7	Roof 2 CLOSE
8	Common

Connector 4

1	S1 OPEN
2	Common
3	S1 CLOSE
4	Common
5	S 2 OPEN
6	Common
7	S2 2 CLOSE
8	Common

Connector 5

1	Stir Fan
2	Common
3	CO2
4	Common
5	Alarm contact
6	Alarm contact
7	24V AC
8	24V AC (com)

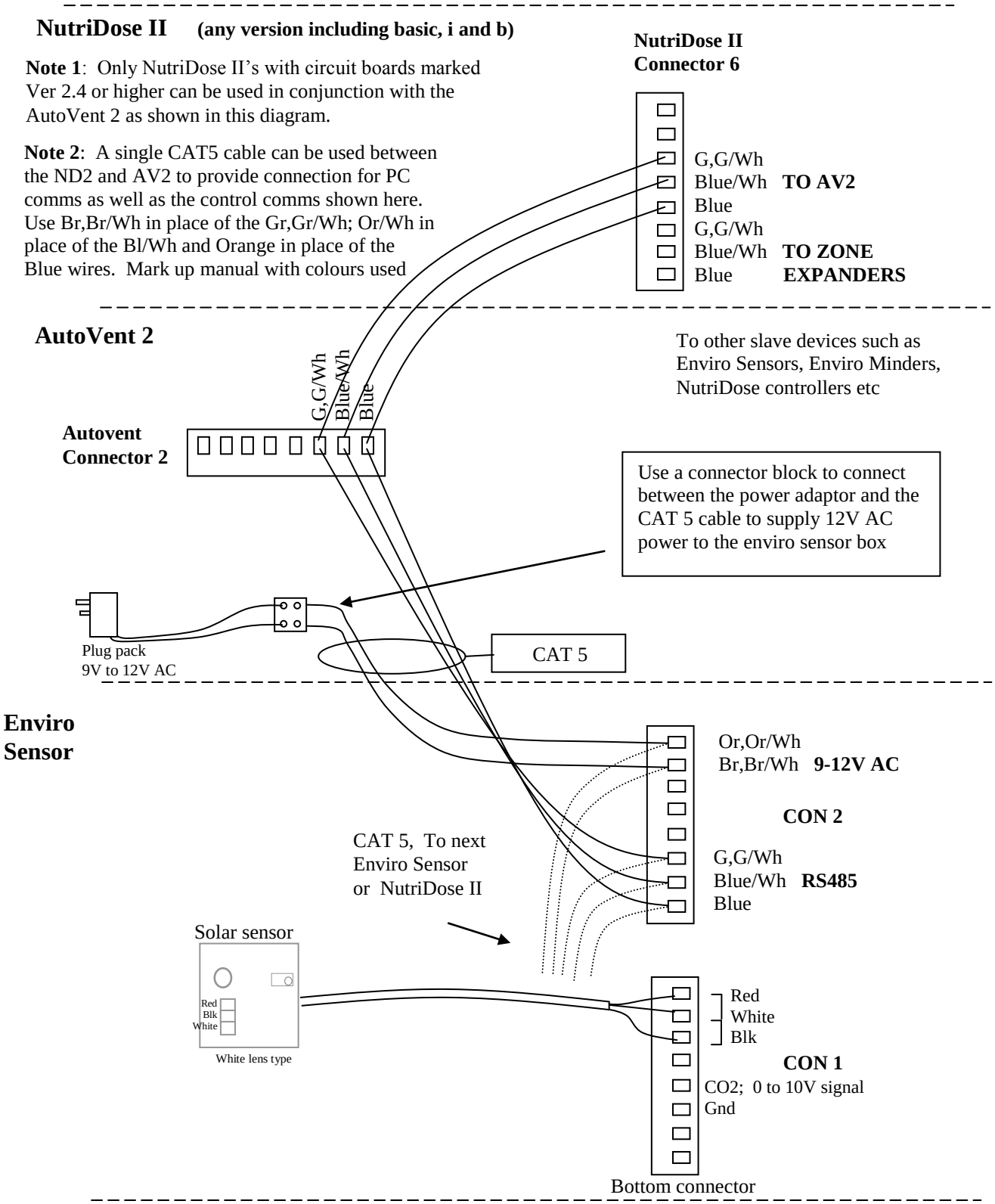
Connector 6

1	Fog pump
2	Common
3	Fog pulse
4	Common
5	ON/OFF heater
6	Common
7	ON/OFF extract
8	Common

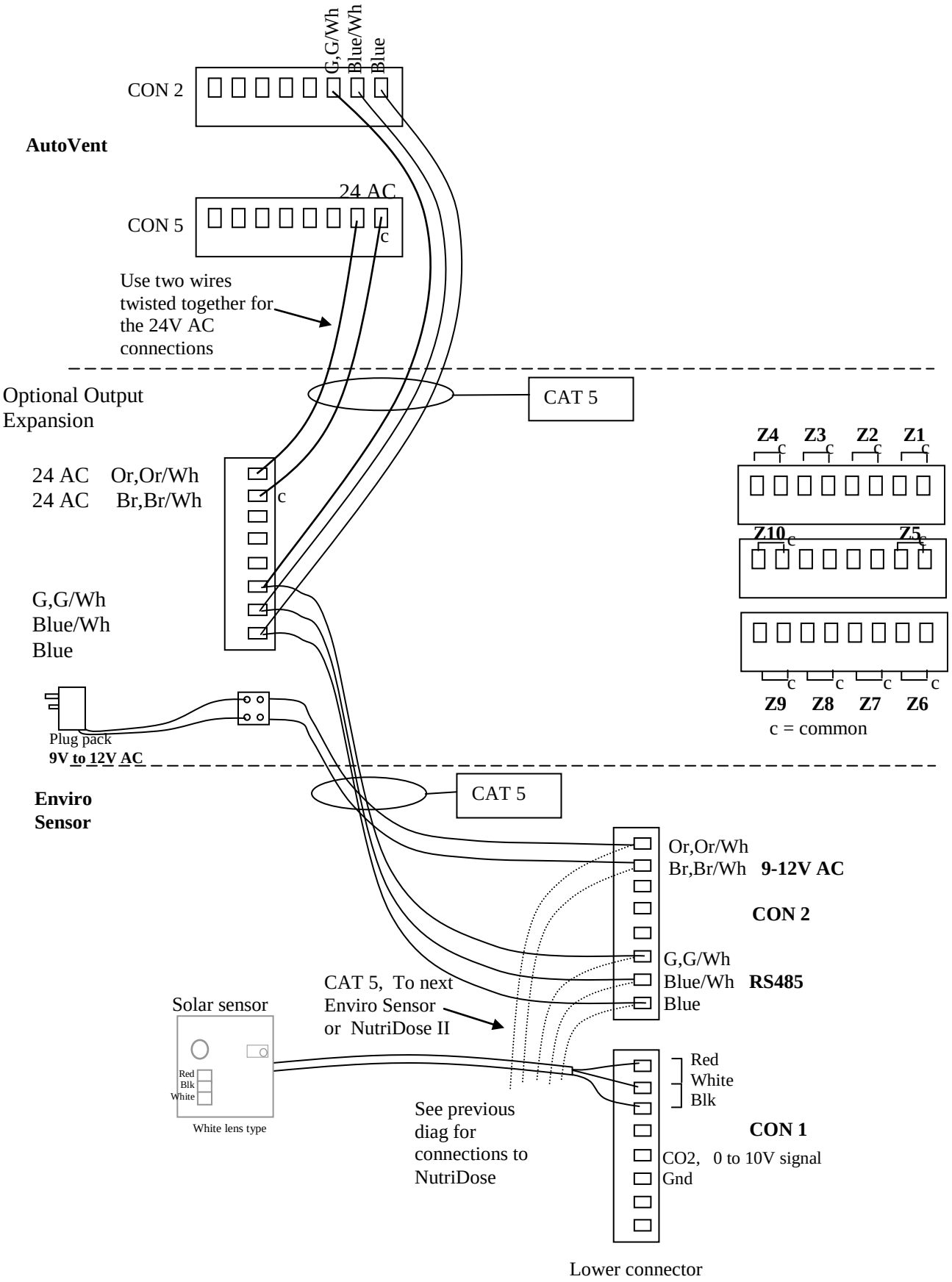
Notes:
For a Gull-wing or Venlo style house connect the east vent to roof1 and west vent to roof 2 connectors. For a saw-tooth house connect the leading vent as roof 1 and the intermediate vents as roof 2.
S2 can be connected to either a second side vent or a shade cloth drive.
All commons are connected together and you may use a single common wire to each sub-system

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.

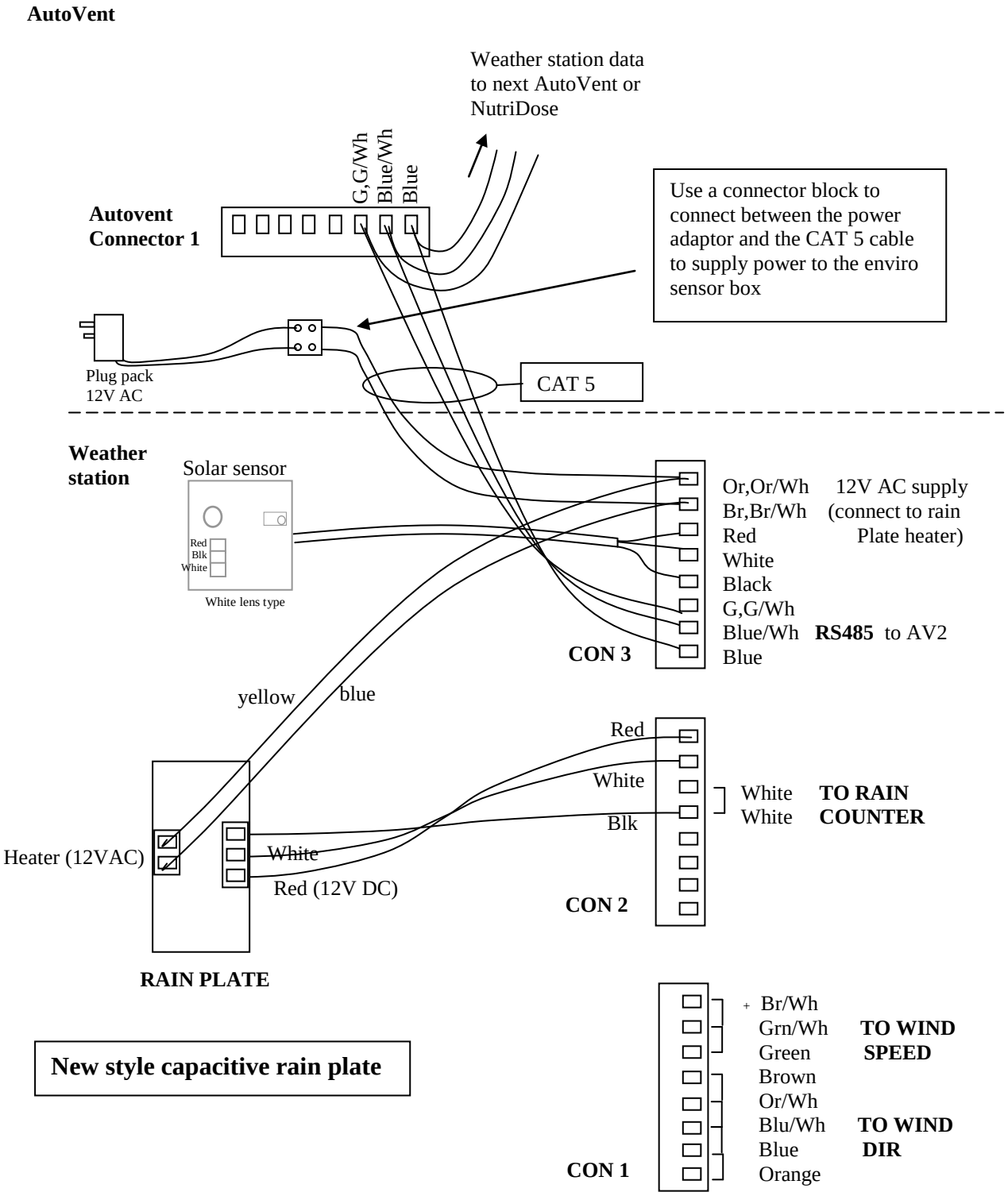


Connections from AutoVent2 to Output expander (if used) and Enviro Sensor(s)

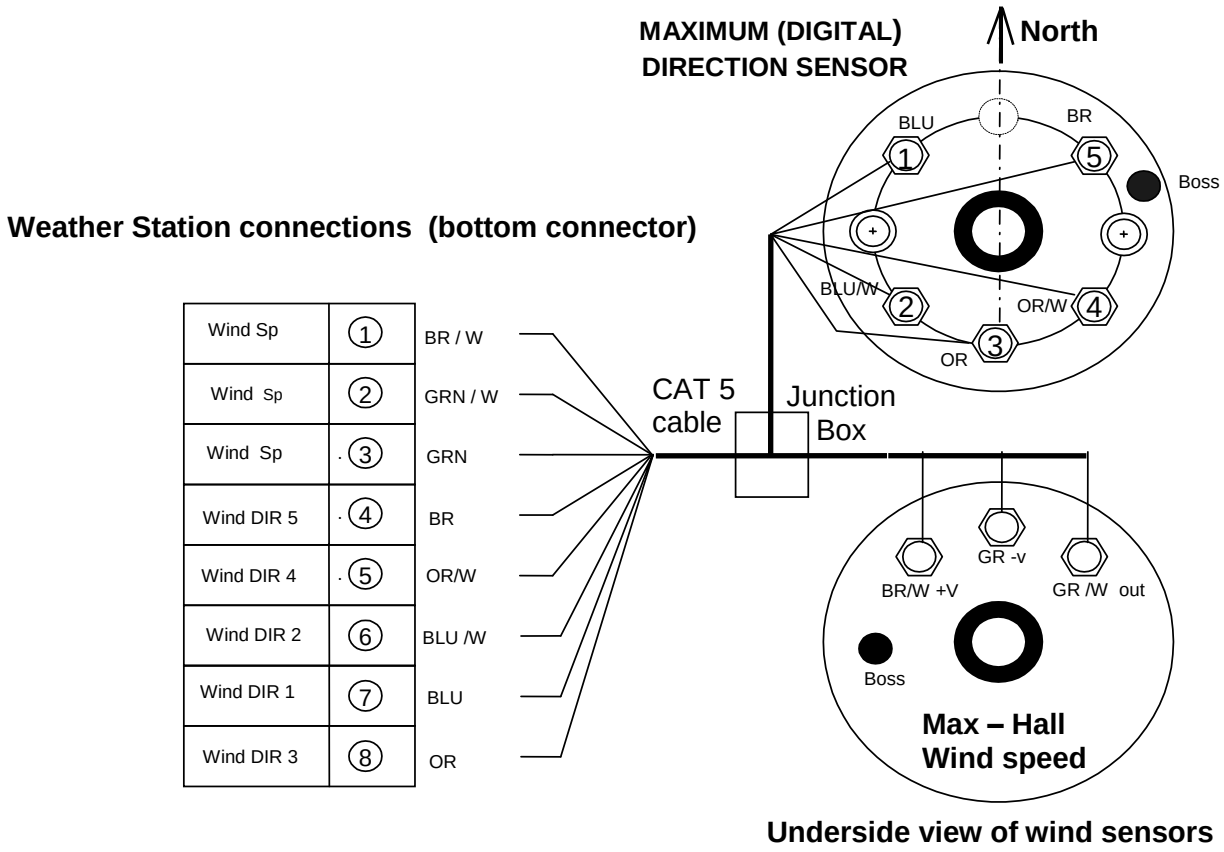


Weather Station connections

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.

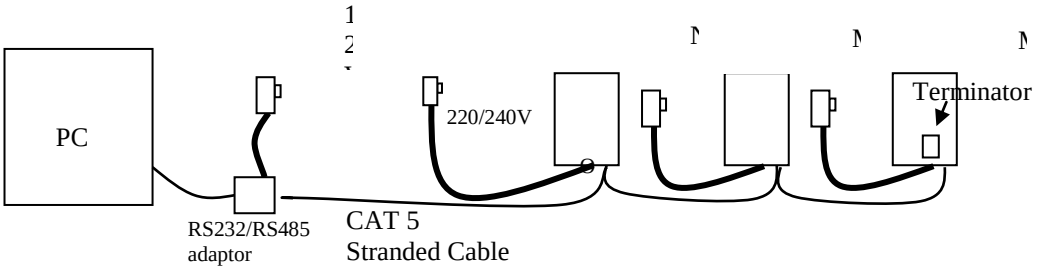


Connection of Wind Sensors

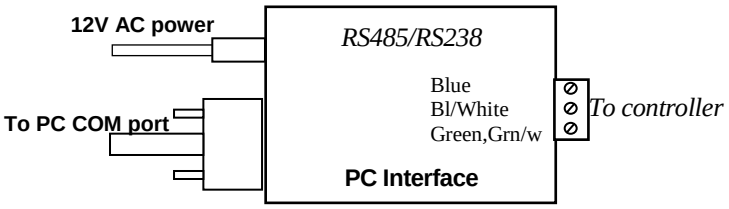


Connections to PC

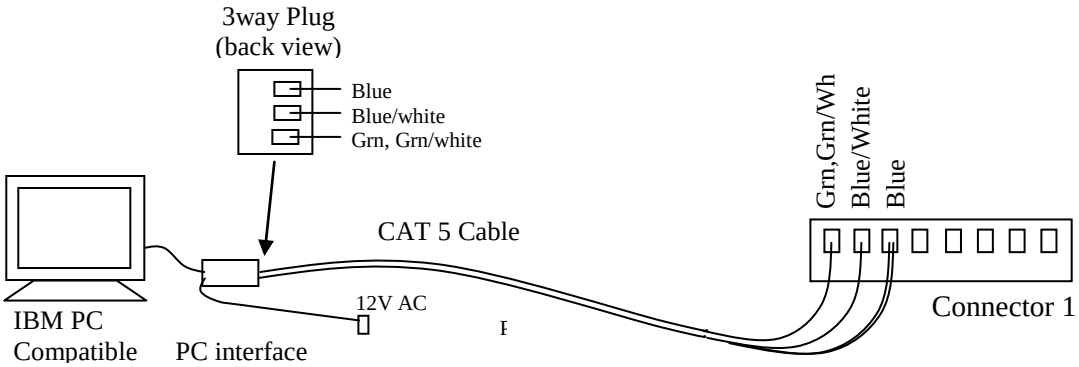
Use light coloured (so as not to attract heat) CAT5 stranded computer network cable between the PC interface and the AutoVent and/or monitors. This cable is "looped in" to each controller/monitor in a "daisy chain" fashion. The last monitor (and only the last monitor) in the chain must have a "terminator"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

5. 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 coated in water repelling varnish to make them more moisture resistant.
Clean the rain plate on the weather station with a soft damp cloth. Be careful not to scratch the surface which is coated with two thin layers of UV stabilize epoxy paint. If this surface is ever scratched it should be immediately touched up with a thin coat of high grade exterior paint – preferably epoxy.
Check the humidity reading and if incorrect replace the electronic sensor. This sensor will need to be replaced every year or two.
Keep all controllers clean and dry and free from vermin and pests.

6. 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.

Red
Blk
White

7. 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.