Automatic Vent Controller
For roof and side vented Greenhouses

AutoVent 1 mK2

Operator and Installation Manual

CONTENTS

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1. Overview

AutoVent 1 is an advanced venting controller designed to monitor and control the internal temperature (and optionally, the RH) of a greenhouse. It is suitable for use with various greenhouse configurations including:-

- Single roof vents
- Twin roof vents (independent gull wing type)
- Roll-up roof curtains facing one direction (end curtain independent of others)
- Side vents
- and a combination of roof and side vents
- all with optional ON/OFF Heater

The AutoVent 1 measures the temperature of the growing environment and compares this temperature with its setpoints. One setpoint is set to control the opening and closing of the roof vent(s) and another is set to control the opening and closing of the side vent (if fitted). If an aspirated temperature/humidity sensor box is installed then the temperature set-point may be modified to either increase the vent opening (for high RH) or reduce it (for low RH). The maximum amount that the "calculated" set-point may differ from the actual set-point is set by the grower. The RH will also modify the heater set-point such that a high RH will increase the calculated heating set-point in order to dry out the air.

After comparing the measured temperature to the "calculated" system setpoints, AutoVent 1 will activate the appropriate response. If the temperature is below or above a setpoint by more than 0.5 Degree/Celsius then the appropriate vent will be "nudged" open or closed. The user can set the nudge percent. Nudge percent simply refers to how far the vents will open or close in each operation.
Note that when opening from fully closed, the first nudge will be restricted to 1/3 of the set nudge size, the second nudge will be 2/3 and subsequent nudges will be full sized nudges. Also not that the first nudge from fully closed will apply to a single vent only (if direction sensors are fitted this will be the leeward vent and if direction is unknown then it will be roof vent 2).
After each nudge, the controller will wait a minimum time before nudging the vents again. This detent is fixed at 3 minutes when opening and 2 minutes when closing. There is also a minimum time of 3 seconds between any operation and the next to avoid motor overrun on quick reversals. **WHEN USING THE MANUAL SWITCHES THE USER TAKES RESPONSIBILITY TO ENSURE THAT NO QUICK REVERSALS ARE MADE.**

AutoVent 1 also has wind and rain sensor inputs. If a strong wind or rain is detected by the system then AutoVent 1 can be programmed to close the roof vent. After 5 minutes the system will check to see if it is still windy/rainy.

If a single rotary speed sensor is used then at the first wind setting Vent 1 will close (typically the outer vent on a saw tooth greenhouse) then at the second setting vent 2 (typically the intermediate vents on a sawtooth house) will close to 30% and then at the third wind setting all vents will fully close.

When both wind speed and direction sensors are fitted, the windward vent will close first followed by the leeward vent and finally the side walls.

Note that when using the manual switches, the reported percentage open will become incorrect as it only tracks vent movement when switched to automatic. The controller will gradually correct this situation as it will automatically try to open the vents every 30 minutes even when they are fully open. Of course the vents will not actually move as the motors will be stopped by the limit switches. Similarly, when fully closed, they will try to close at 30 minute intervals.
The complete time to go from fully closed to fully open set by user. For example, if the total time to open the vents was 90 seconds then a nudge time of 30 seconds would open or close the vents by 33%.

2. Settings

Before the main menus is the status menu which shows readings positions and a summary of setting. To move up and down through the status menu use the UP and DOWN arrow keys. Pressing the MODE key at any time will take you to the MAIN MENU.

The settings menus are arranged in two levels with the main menu at the top level with sub-menus below. To step through the main menu press the MODE key and when the cursor is on the desired sub-menu press the UP arrow key once. Then to step through the sub-menu, continue pressing the MODE key. When the desired function is reached, press the up and/or down key to change the setting, finally pressing the SAVE key to save and exit that sub-menu. Settings are saved in permanent memory and will remain even when power is removed.

Note that depending on the switch settings, only the relevant screens will display.

Screens

a. Normal display showing temperature and both roof /side calculated setpoints.
b. Status screen-shows vent percentage open.
c. Environment readings summary
d. Calculated Setpoint Summary
e. Wind information

MAIN MENU
M1. Settings 1 - Venting and heating settings
M2. Settings 2 - Rain and wind settings
M3. Settings 3 - Roof/side settings
M4. Settings 4 - Purging etc
M5. Settings 5 - Alarms
M6. Settings 6 - RH settings and calibrations

SUB-MENU from M1
M10. Roof venting set-point
M11. Side venting set-point
M12. Heater enable/disable
M13. Heater set point

SUB-MENU from M2
M20. Close vents on rain - select from both, wind-ward only, none)
M21. Close on wind - ball type wind switch only – select from ww, both
Alternative M21 when DIP switch set for rotary speed sensor….
M21. Close WW roof vent at xx KPH - only available with rotary wind speed
M22. Close LW roof vent to 30% open at xx KPH - as above
M23. Close all vents at xx KPH – fully close all roof and side vents

Key: WW = windward, LW = leeward, KPH = Kilometres per hour

SUB-MENU from M3
M30. Roof nudge % - sets how much the vents move each time
M31. Side nudge %
M32. Roof open travel time – Time to move from closed to fully open
M33. Side open travel time – Time for side to move from closed to open
M34. Roof vent 1 orientation – (only used with wind Direction sensor) enter the direction that vent 1 faces

SUB-MENU from M4
M40. Timed purge enable/disable
M41. Purge open vent to xx % - set the amount the vents should open
M42. Purge open hold time xx secs – set how long vent should stay open
M43. Purge interval detent – time between purges
M44. RH purge enable/disable
M45. RH purge humidity set-point
M46. Increase heating SP when RH purging by xx ^{o}C

SUB-MENU from M5
M50. Alarm ON/OFF
M51. Alarm Temperature minimum xx ^{o}C
M52. Alarm Temperature maximum xx ^{o}C
M53. Alarm RH minimum xx %
M54. Alarm RH maximum xx %
M55. Alarm detent – time in seconds after fault condition before alarm sounds

SUB-MENU from M6
M60. RH set-point - enter the desired RH
M61. Increase calculated venting SP by xx ^{o}C when RH is low
M62. Decrease calculated venting SP by xx ^{o}C when RH is high
M63. Increase calculated heating SP by xx ^{o}C when RH is high
M64. Calibrate RH – adjust the CAL reading to match a precision instrument
M65. Calibrate Temperature – adjust the CAL reading

Notes on readings and settings

The windward vent closes when the "effective" wind speed exceeds the set point. The effective wind speed is "cosine corrected" for approach angle to find the equivalent wind blowing straight into the vent.

Accurately time the total time for the roof and/or side vents to move from fully closed to fully open and enter this in SETTINGS 3. Also make a note of these timings in case you ever review the settings.

The nudge setting should be made with care as a very small nudge size will mean that whilst giving greater precision of vent position, the vents open and close very slowly. Start with a setting that gives 10% to 20% change on each nudge. In cold climates in winter adjust this setting to the lower value but in summer increase it to get a quicker reaction time.
Normally set the side temperature set-point about 2 or 3 degrees above the roof set-point.

For humidity control we suggest that the the desired RH is set to about 70% as this suits most crops. Then set the changes in temperature set points to 2°C each as a starting point. Make sure that the heater set point is sufficiently below the venting setpoint so that even when they are modified by the +/- 2°C they do not overlap excessively.

If you have the aspirated enviro sensor then enable the RH purging rather than the timed purging. And set the purge open % to a few percent in winter and a bit larger in summer. Then set the purge open time to a few seconds in winter and a bit longer in summer. Finally, set the purge detent to between 10 and 30 minutes as a starting point. These settings should be adjusted in the light of experience and will depend on the greenhouse style, and severity of the humidity problem. If a heater is installed, set the purge temperature increase to about 5 °C.

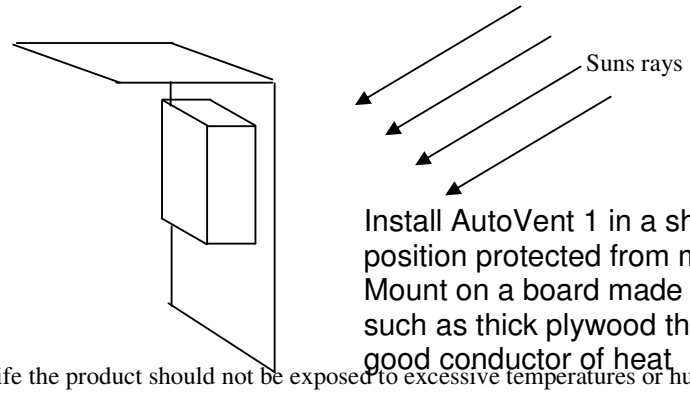
For most greenhouses a good starting point for the wind settings is as follows:- Set the initial wind threshold at about 20KPH, the second threshold at 40KPH and the "close all" third threshold at 50KPH. You may need to vary these, depending on the type of greenhouse, the risk of sudden high winds and on the temperatures.

The ball-on-stick wind switch detects both wind direction and wind speed and is set to operate at approximately 40KPH. This is suitable for robust gull wing type houses as it will close only the windward vent. (Of-course, you must ensure that the wind sensor is positioned so that its side1 is facing in the same direction as the side1 vent).

Greenhouses in windy hot areas may need to have an auxiliary extraction fan that is controlled by a thermostat set to a little above the normal venting set point. This ensures that in hot, windy conditions if the vents are forced closed the extraction fan will come on and help stop the temperature from becoming dangerously high.

3. Installation and storage

IMPORTANT:AutoVent 1 must be installed (and stored) in the shade. It must never be left in full sunlight or in very hot conditions such as in an automobile glove box.
Normally this means that a shade cover must be provided in the greenhouse or control room to protect it from the suns rays. This is important as the surface temperatures of items in a greenhouse in summer, in full sun, may easily exceed 60 deg C (140 deg F). **If this is allowed to happen the warranty is voided**. The shade cover will also prevent condensation drips falling onto the controller.



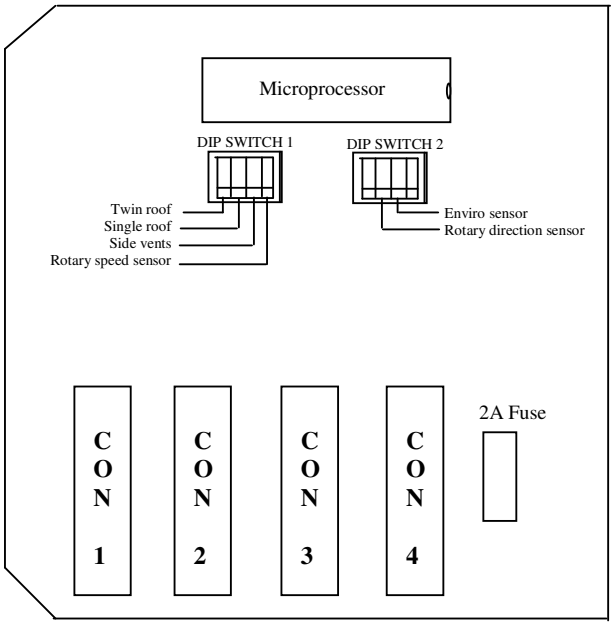
For the longest life the product should not be exposed to excessive temperatures or humidity for long periods of time.

Install the wind sensor in a position where it will reliably detect the wind speed and true direction. For the ball-on-stick sensor, orientate the sensor so that the side one marker points in the same direction as the side one vent of the house. For single roof vented houses or roll-up curtain houses point the side one marker in the same direction that the vents face. Test this by manually pushing the ball in one direction and observing which vent closes.

Mount the rain sensor at a slight angle so that rain water will gradually run off and allow the heater to dry off the remaining droplets.

The outputs to drive the vents are 24V AC with a maximum current of 0.5 Amps (12VA). These can be used to power relays which provide the mains power to drive the vent motors. Autogrow can provide a relay box with motor overload protection if desired.

PCB LayOut



NB: Close switch (ie switch ON) to enable function

DIP SWITCH 1

Sw 1 - Twin independent roof vent (either gull wing or roll-up-curtains with separate motor drive to end curtain)
Sw 2 - Single roof vent
Sw 3 - Side wall curtains
Sw 4 - Whirligig wind sensor

Switches 1 and 2 may both be open (no roof vents) or either of them may be closed but NOT both.
When a single roof vent is selected, roof 1 outputs will be used and roof 2 output will be disabled.

Recommendations:-
For houses with twin roof vents such as gullwing or venlo style, the rotary speed and rotary direction sensors provide the best solution and they provide both speed and direction information. The ball on stick sensor also provides a rudimentary indication of both speed and direction so that the appropriate vent can be closed

For greenhouses with roll-up roof curtains facing in one direction the rotary speed sensor is recommended. Then connect outputs for roof vent 1 to the leading edge vent and outputs for roof vent 2 to the inner vents. Set the system to close one roof vent on wind so that the leading edge curtain closes at threshold 1 and the inner vents at wind threshold 2.
Alternatively, if the ball-on-stick sensor is used, connect the inner roof vents to the side vent output so that they close when threshold 2 is reached. In this case you may want to set the temperature setpoint for the "side vents" to be the same or even lower than that for the leading edge roof vent.

For side vented houses with no roof vents the whirligig sensor is preferred. Set threshold 2 to the wind speed at which you want the sides to close.

DIP SWITCH 2

Sw 2 - Switch ON if a rotary direction sensor with interface is connected
Sw 3 - Switch ON if an aspirated environment sensor is connected

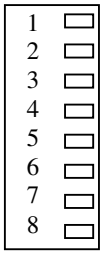
4. Connections

Note: Do not run wires from the AutoVent 1 sensors in close proximity to main cables ie. Do not run in the same conduit, trunking or bundled together.

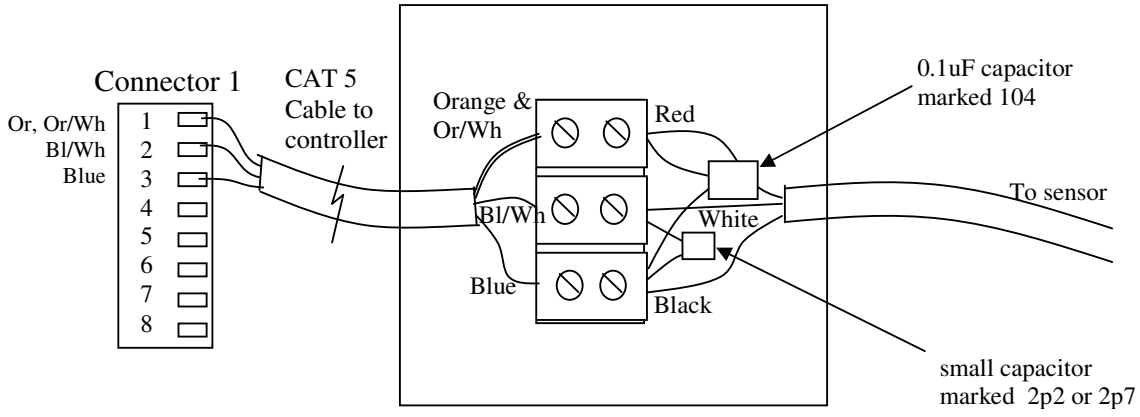
It is important to use STRANDED CAT 5 CABLE and to use the wire colours suggested. This will ensure that a "twisted pair" of wires is used for both signal and return.

Connector 1 – Simple temperature sensor

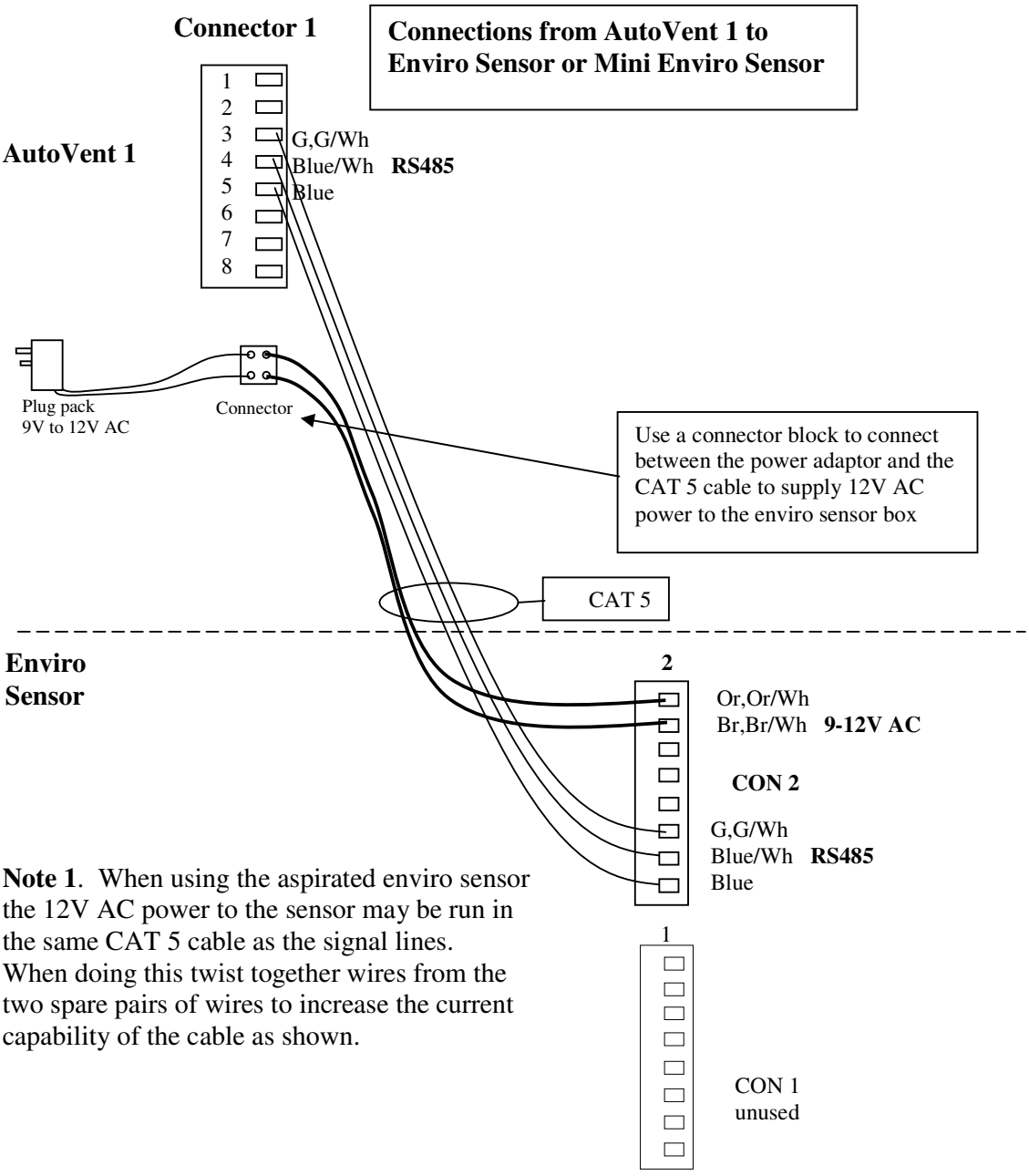
1: 5-Volt supply to temperature sensor (Red sensor lead)
2: Signal input from temperature sensor (White sensor lead)
3: GND to temperature sensor (Black sensor lead)



Note 1. When using the simple temperature sensor the sensor lead may be extended by up to 40metres provided that computer CAT5 network cable is used. When this is done it is strongly recommended that noise suppression capacitors are fitted at the junction between the sensor cable and the CAT5 extension cable. The diagram below shows the connections required.



Connector 1 – Mini or Aspirated temperature sensor
3: Green, Green/white CAT 5 cable wire to enviro sensor
4: Blue/White CAT5 cable wire to enviro sensor
5: Blue CAT5 cable wire to enviro sensor

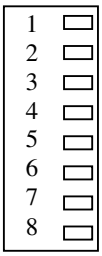


Note 1. When using the aspirated enviro sensor the 12V AC power to the sensor may be run in the same CAT 5 cable as the signal lines. When doing this twist together wires from the two spare pairs of wires to increase the current capability of the cable as shown.

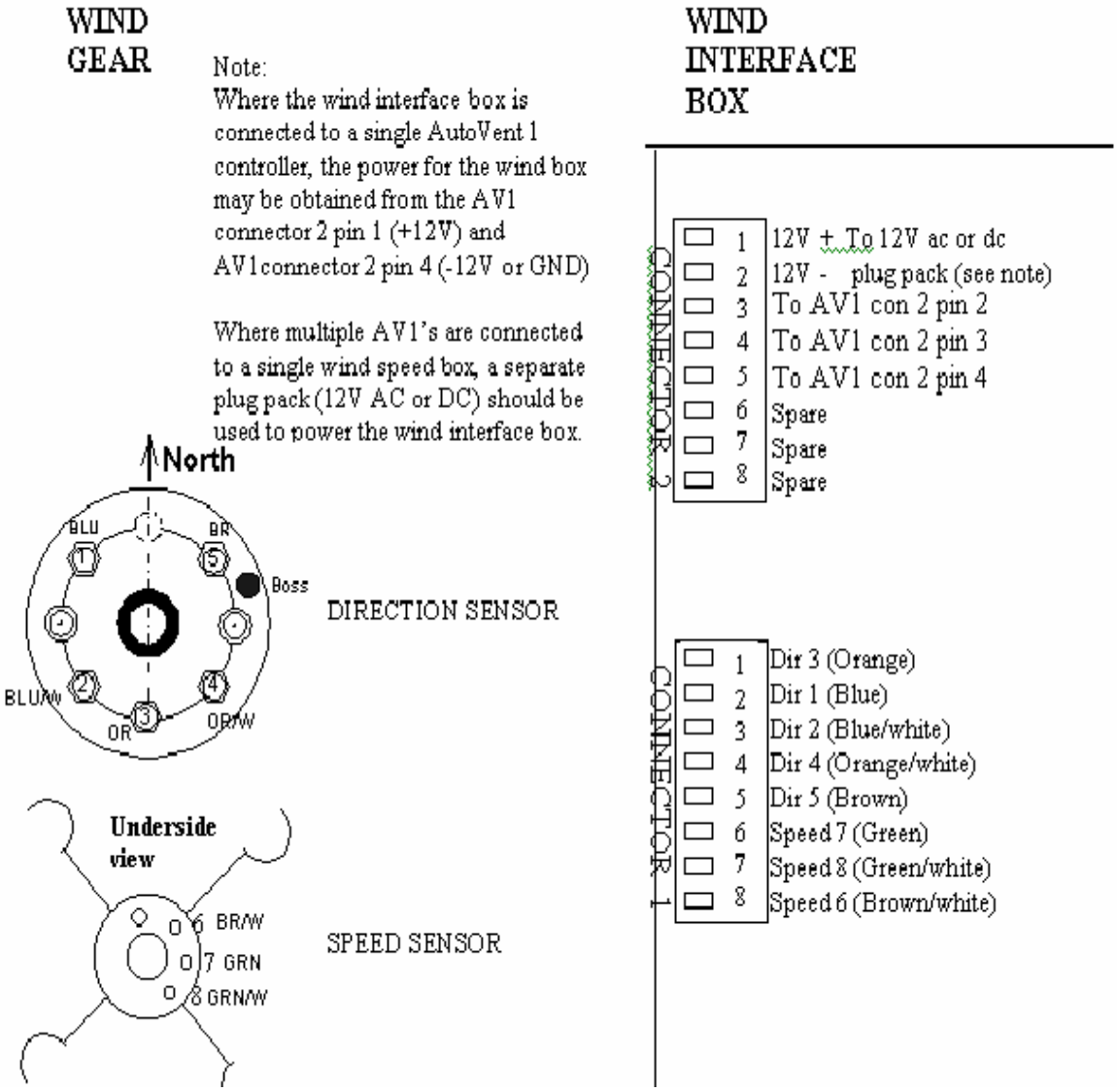
Note 2.
Both simple temp sensor and enviro sensor may be used at the same time. When this is done, if ever communication is cut to the enviro sensor, control will switch automatically to the simple sensor.

Connector 2

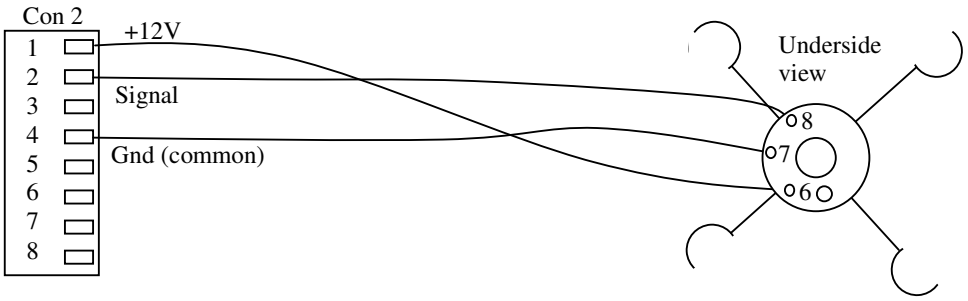
1: 12 Volt DC supply output (can be used to power peripherals, see note)
2: Wind speed signal (Interface box con 2 pin 3)
3: Wind direction signal (Interface box con 2 pin 4)
4: GND (common from rotary sensor or interface box)
5:
6: 12V DC output to rain sensor (red)
7: Rain sensor signal (white)
8: GND (black)



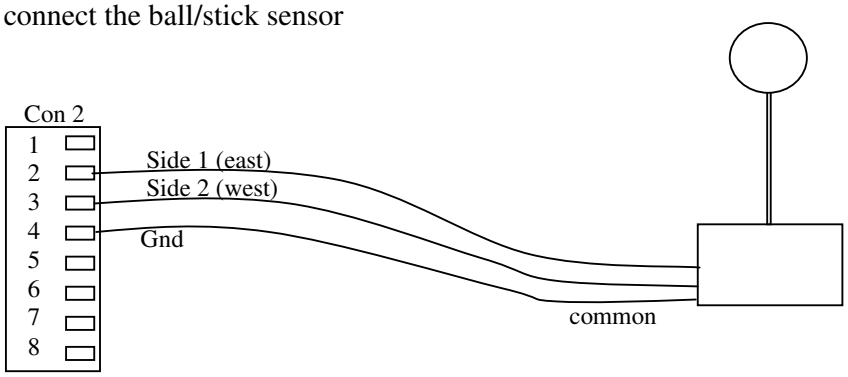
To connect a rotary anemometer AND a rotary direction sensor to interface box



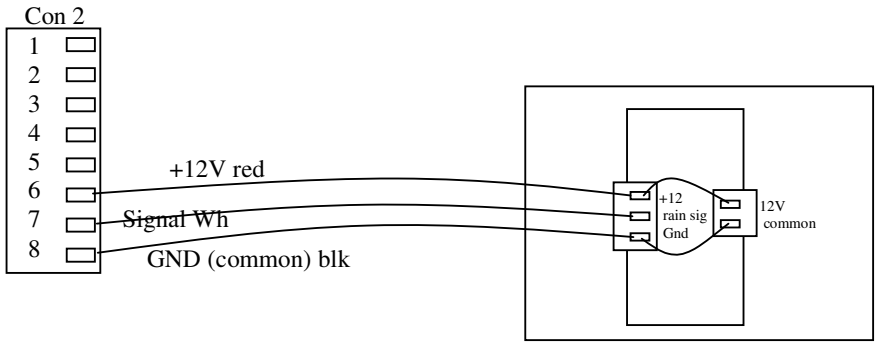
To connect a rotary anemometer **WITHOUT** a rotary direction sensor



To connect the ball/stick sensor



To connect rain sensor

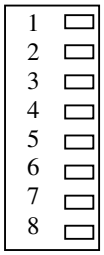


Connection to rain sensor

Mount the rain sensor on a slope of 20 to 40 degrees to horizontal so that water will run off freely. Always mount the sensor with cable entry at the lower end and check that the case is water tight. A small hole may be left at the lowest point of the box so that any water entering the box can run out

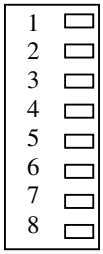
Connector 3

1: Side vent open output (24V)
2: **Common**
3: Side vent close output (24V)
4: **Common**
5: Roof 2 open output (24V)
6: **Common**
7: Roof 2 close output (24V)
8: **Common**



Connector 4

1: Roof 1 vent open (24V)
2: Common
3: Roof 1 vent close (24V)
4: Common
5: ALARM
6: ALARM
7: Heater (24V)
8: Common



For a gull-wing style roof vent connect roof1 output to the east vent and roof 2 output to the west vent. For saw tooth house use roof 1 for the end vent and roof 2 for the intermediate vents.
Connections 5 and 6 provide a contact closure in the event of an over-temperature alarm. Do not exceed 24V AC or DC at 1Amp on these contacts.

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 authorisation .
RH sensors and fans carry only a 6 month warranty from their respective manufacturers. Wind and rain sensors have a 1 year warranty.

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.

WARNING

When using the manual override switches on the front panel it is important that the vent motors are allowed to fully stop before reversing the direction. The operator