

MINDER

User Guide and Installation manual

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2. Settings
3. Calibration
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5. Installation

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Appendix 2 - CO2 sensor setting and calibration

Appendix 3 - warranty



1. General Overview

The award winning *Minder* logs important growing information to the PC. This information is then displayed graphically so that trends etc can easily be spotted. It also allows smart alarms to be set so that if anything goes wrong you will soon be notified.

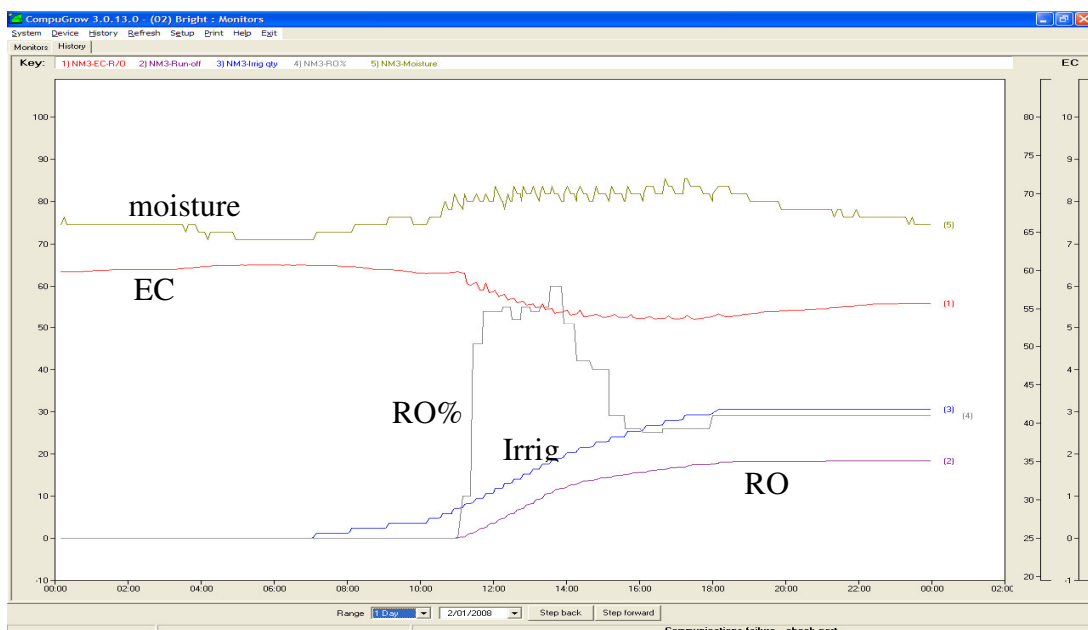
The base unit comes with a variety of sensors to monitor a wide variety of parameters. The root zone sensors are conveniently connected to the minder via a Root-Zone interface box. This can be positioned at some distance from the Minder enabling the Minder to be mounted in the aisle, at the end of a row with the sensor box located some distance into the row where the sampling is possibly more representative of conditions throughout the greenhouse. A CAT5 **plug-in** patch cable is used to connect these items together.

The following sensors may be connected via a Rootzone interface box (supplied with a 5m patch cable)

- Root zone moisture
- Root zone temperature
- Run-off quantity
- Run-off EC
- Run-off pH
- Irrigation quantity
- Irrigation EC
- Irrigation pH
- Solar energy
- { twin sensors for TOTAL energy (Joules/cm²) and PAR (umol/m²/sec)}

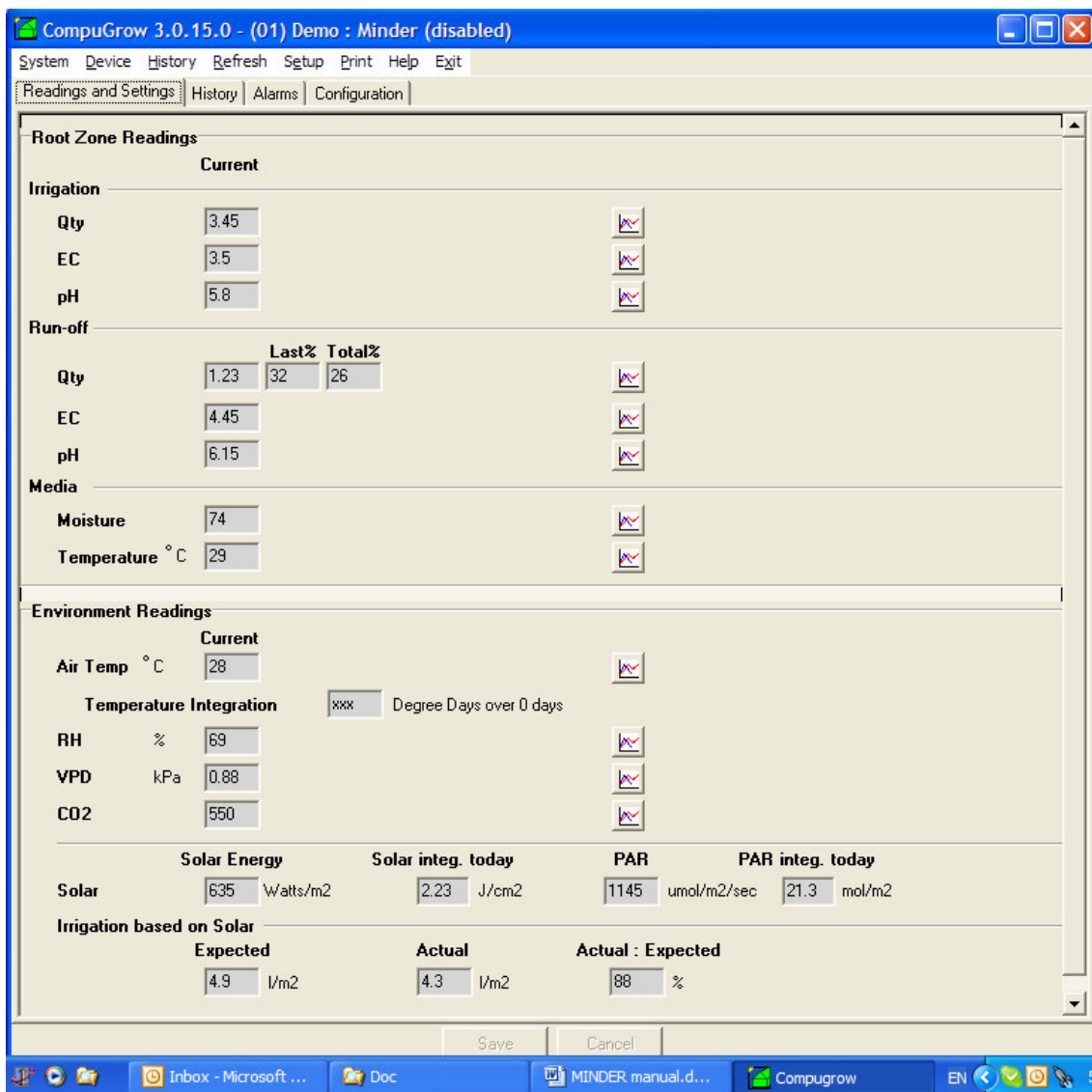
The MINDER may also be used to monitor general environmental conditions by connecting one of our standard aspirated enviro sensors.

- Air temperature
- Air humidity
- VPD (based on air temperature)
- CO₂
- solar energy
- { twin sensors for TOTAL energy (Joules/cm²) and PAR (umol/m²/sec)}



Readers familiar with our existing product range will realize that this new MINDER is an enhanced combination of our old EPT run-off monitor and TRS environment monitor together with a lot of new features. Together, these measurements give a complete picture of what is happening at one of the plants most important places; it's root zone, together with information on its irrigation requirements and environmental conditions.

Readings



The Irrigation and Runoff quantities are presented as milli litres per dripper. These are calculated by the MINDER from the number of tips on the quantity gauge together with the ml per tip and the number of dripper contributing to that flow quantity. This allows the grower to make direct comparisons between the two readings.

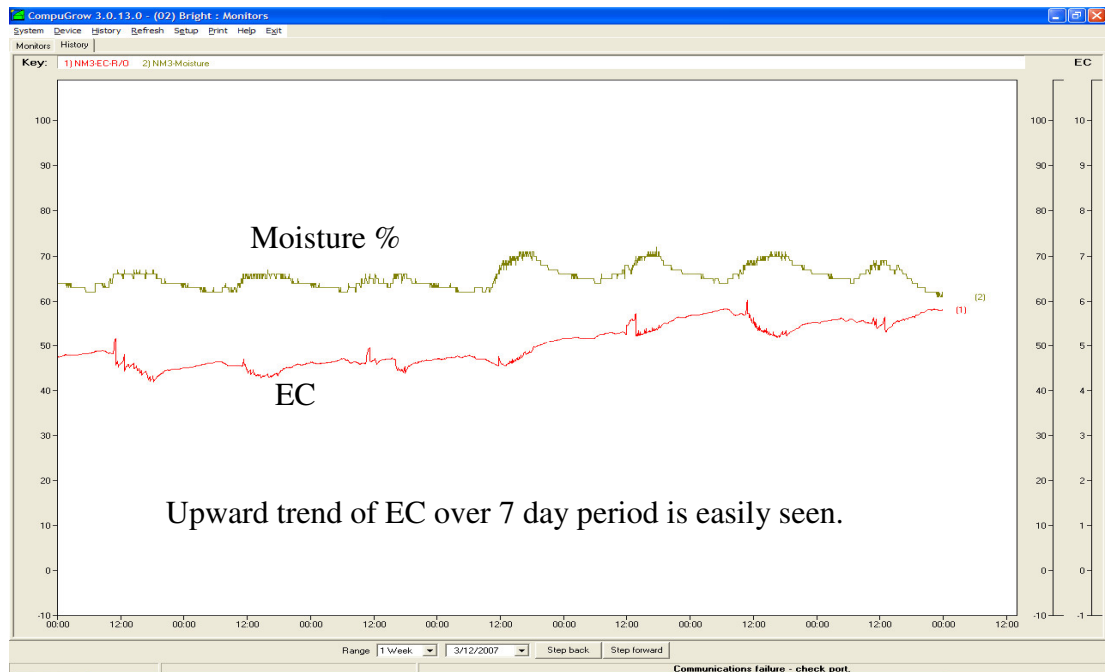
EC may alternatively be presented in CF units if the user if preferred. This is changed globally, across all connected controllers by going into the main setup menu and selecting "units". Similarly temperature may be represented in Celsius or Fahrenheit.

pH is always represented in pH units and CO2 is represented in ppm

Irrigation based on solar is calculated from the solar integral so far today and the expected irrigation per m2 per Joule. For a vine crop this is about 3ml/m2 per J/cm

Important ratios

In addition to displaying the values read from the sensors, important ratios are automatically calculated and displayed. For example, the ratio of the runoff to irrigation quantity is calculated and displayed as a percentage. This is done for both the last complete irrigation and the total for the day so far. The ratio of actual irrigation quantity to the expected quantity (based on solar integral) is also displayed. Temperature integral for the last period (eg 7 days) is also calculated together with the solar integral for the same period. These figures can be used to determine the expected yield. All data is stored on the PC hard drive and is available for export to a spreadsheet for further evaluation.



Advanced alarms

For many growers, time specific events are more important than simple alarms based only on a minimum or maximum value. Knowing whether "runoff" has occurred by, say, 11:00am or whether runoff EC has been brought down by mid-day is more critical than simple numeric values. The minder has the ability to set up complex alarms based on values or ratios together with a holding time and a time-of-day period. Furthermore, these alarm rules can be given various priority levels allowing say a warning to be issued at 10:30am followed by an emergency alarm at 11:00am and a text page to your cell phone at 11:30 if runoff has not been achieved.

General

Many growers pay a lot of attention to the EC and pH of the water that is fed to the plant but little attention to what is actually in the root zone and what is running out at the bottom. These latter values are much more important than the input values. In fact, the inputs should be adjusted together with irrigation timings to achieve appropriate runoff values. By adjusting things like the watering start/stop times, watering quantity, watering interval (solar trigger count) and the root-zone EC it is possible to have considerable control over the plant and to "steer" the crop to be more or less vegetative or generative. This is often called "balancing" the crop. To do this properly, the grower needs really good information and this is exactly what the MINDER provides.

By monitoring solar energy as well as root zone parameters it is possible to correlate this against irrigation volume and even set alarms on this other very important ratio.

Hopefully, the run-off will be cleaned and re-used but if any is allowed to escape into the environment - eg sprayed over pasture etc, this monitoring system can be used to provide records of this.

All data, including the run-off ratio and irrigation quantity per unit solar energy, are graphed on the PC providing vital information for successful growing.

If your PC ever goes off-line the MINDER will continue to log data for over a week. As soon as the PC is reconnected the locally stored data is automatically up-loaded.

Collection point



Small collection Point

Moisture Sensor



2. Settings

Settings are most conveniently done at the PC although a few are only available at the MINDER itself. For example, the communications address must be set at the MINDER and calibrations are also available only at the minder.

The MINDER has complex alarm rules which, because of their complexity, are only available at the PC. However, once set, they are stored in the MINDER itself which may then be disconnected from the PC.

We will first consider the settings available at the PC.

After installing a new MINDER the first thing that must be done is to set a unique communications address both at the MINDER and also at the PC. See section “Setting up PC software” Once communication is established the rest of the settings can be made at the PC and saved to the MINDER in it’s non-volatile memory.

Configuration

The configuration tab is where you tell the PC and the controller what sensors it has to work with and other information about the system.

CompuGrow 3.0.13.1 - (01) Demo : Minder (disabled)

System Device History Refresh Setup Print Help Exit

Readings and Settings History Alarms Configuration

Configuration

Root Zone Sensor

Run-Off

Qty
EC
pH

Sensor Serial Number: ASLSC08090002

Irrigation

Qty
EC
pH

Sensor Serial Number: ASLSC08090003

Media

Moisture
Temperature

Enviro Sensor

Air temp
RH
CO2

Number of days for temperature integration: 7

Solar Sensor

Sensor Serial Number: ASLSS08090005

Settings

Run-Off Qty per tip: 5

Irrigation Qty per tip: 5

Expected irrigation qty based on solar: 3 l/m2 per Joule/cm2

Drippers R/O: 4 : Irrig: 1

Drippers per m2: 2.6

Save Cancel

For most items in the configuration tab, all that is needed is to tick the check box if the sensor is connected and working. For some, a serial number is required and this will automatically be presented to you after the device has been automatically detected.

When first switched on the system will search for peripherals and will automatically install them in the order that they are found. You will then need to place the appropriate EC sensor in the correct sample point. The sensors can be identified by their serial numbers or by placing one in some nutrient solution and then checking which one is reading. Then place it into the appropriate collection point. Once the system has been configured the sensors will never change unless a sensor is renewed or the controller is changed.

NOTE: When changing or swapping peripherals from one MINDER to another, always return the MINDERS to factory default settings as follows:-

- 1) Switch off power
- 2) Hold in both arrow buttons
- 3) Switch on power

This will delete all previously detected peripherals and will start a new detection search. Allow a minute or two for the search to complete.

The small rectangular tipping bucket rain gauges have a “quantity per tip” of 5 mls although larger sensors up to 50mls per tip can be supplied

Under “Drippers” it is necessary to enter the number of drippers contributing to the runoff “R/O” and also the number of drippers contributing to the “irrigation” quantity collected.

Next, the expected irrigation quantity per Joule of solar radiation should be entered. This is simply the amount of irrigation water that you would want to be applied perm² of growing area for every Joule/cm² of solar energy.

Finally, the number of drippers per m² is entered. In the case of crops like tomatoes, this is normally the same as the number of tomato plants per m².

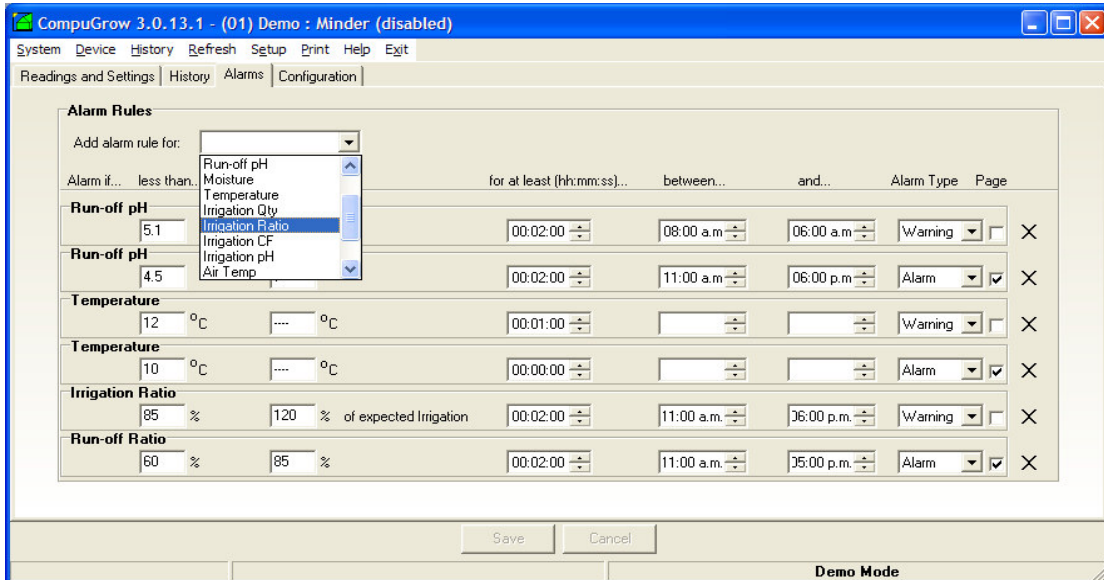
Alarms

The MINDER has a very flexible and advanced alarm system. Because of their complexity, alarms can only be set from the PC. However, once set, they are stored in the minder so that if it should go off-line they will still be active.

For example, the same type of alarm can be set multiple times such that when the first condition is met a warning condition will persist, when the next condition is met an alarm may sound and when the third condition is breached a page or TXT message can be sent.

The alarms are built up as rules with the basic structure:-

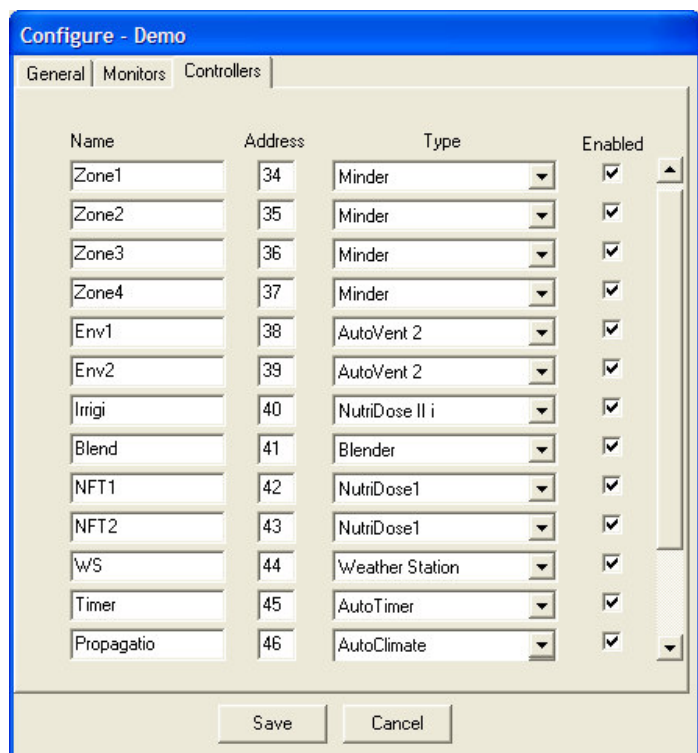
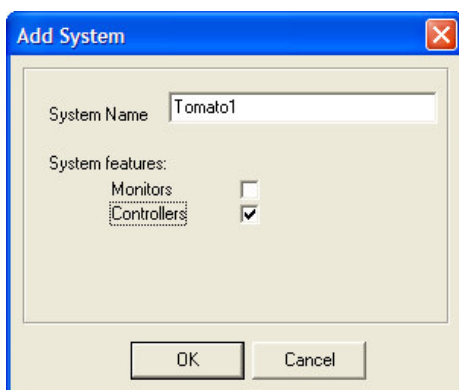
```
ALARM IF <runoff ratio> IS LESS THAN <50%> OR MORE THAN <80%> FOR  
AT LEAST <00:01:00> hrs:min:secs BETWEEN <09:30> O’CLOCK and <16:25>  
O’CLOCK USING ALARM TYPE <silent/warning/alarm> AND SEND PAGE <x>
```



The fields are automatically disabled when first implemented and if any number has been entered can be disabled by clicking into the edit box and then pressing delete. The entry will show as --- when disabled in this way. Alarm rules like this are available for a wide range of readings and ratios and up to a maximum of 48 rules can be implemented.

Setting up PC software.

Having installed the Compugrow software on the PC (see Installing PC software for details) the address on the MINDER must be set both at the MINDER and at the PC. At the PC this is done by selecting setup/system setup/new and then entering a name for the system that this MINDER is to be part of. Normally, the system name represents a greenhouse or small group of similar greenhouses. Use a short meaningful name and select “controllers” as the MINDER is regarded as a controller type in view of its complexity.



Then in the configure window, give the device a short name, a unique address, select Minder from the pull down *type* menu and finally enable it. Finally “save” the new settings.

Next set the COM port that you are using at the PC if this has not been set previously and check that the PC is communicating with the MINDER. To check this, select the minder in question from Device/controller drop down menu and then look to see if you have any reading values appearing where you would expect them. Try clicking “refresh” on the top menu bar and see if a message such as “off-line” appears at the bottom right of the screen. If so you are not communicating, the COM port setting should be rechecked (try selecting setup/comms/test communications) and if this is OK recheck wiring to the MINDER and that there is only one terminator fitted at the end of the PC bus. Also recheck device addresses are set at both ends and are unique.

In setup/units select the units of measurement that you prefer to work in.

Once you have it communicating properly, the next job is to configure the MINDER. This entails placing a check in each box to tell the system which sensors you have installed. You also need to specify the quantity of water per tip or pulse received from the quantity sensors. For the small rain gauge sensors this is 5ml per tip. Larger sensors are normally 50ml per tip but may be calibrated to something less than this. Next, enter the number of runoff dripper and irrigation drippers being monitored together with the number of drippers per m². The expected irrigation quantity based on solar radiation is the theoretical irrigation requirement per m² for every Joule of solar energy received. For a crop inside a greenhouse with no shading which completely intercepts the suns rays this figure is about 3ml/m² for every Joule/cm² of energy. If your crop intercepts only half of the suns rays then halve this figure. Similarly, if you have shading of 50% then again halve the figure. When the configuration is complete, save the settings. Now, again check your readings. Only readings for the sensors that you have installed and configured will be displayed.

Next, go to the alarm tab to set up alarms. All alarms are set by completing a “rule”. Any value field that is left blank will not be used – for example, if you wanted to have a rule such that the alarm would be triggered if the runoff quantity for the last irrigation was below 10ml per dripper then you would select the rule “runoff quantity” and complete it as follows:- Alarm if less than <10>ml or more than <leave blank> for more than 0:0:1 (ie 1 minute) between <11:30am > and <4:00pm>. Then select the alarm type from disabled, silent, warning, alarm and finally check the paging box if you have a modem set up for paging your telephone or cell phone.

Note that you can have multiple alarms for the same quantity, the first could be to just give a warning and the next could be to sound an alarm if the condition became worse.

On the History tab you can view the logged data graphically. To set this up right click anywhere on the screen and select the Minder of interest. Then you can select which parameters you want displayed and can even change the colour scheme. You can save various set-ups as “favourites” for instant recall in the future. Note that data will only be displayed if the clock in the minder matches the clock on the PC – if you choose “autosynch device clocks” in the “setup” menu this will always be the case. By going to setup/monitor/controller logging frequency you may select between 1 minute and 5 minute log samples. If the MINDER is left off-line then it will default to logging to local memory at 5 minute intervals.

Setting from the MINDER keypad

With the exception of the alarm rules, most settings may also be carried out at the MINDER. In fact, setting the comms address and any calibrations must be carried out here.

From the default readings screen use the arrow keys to traverse the other reading screens.

To access the settings menu system, press the right key below the display and then follow the instructions. When any menu or sub-menu is entered, use the arrow keys to move up or down through the menu. To enter a sub-menu press the enter key and when the actual setting of interest is reached, press the edit key. Then use the up/dn arrows to change the setting and finally save it. It will then be saved in permanent memory on the MINDER.

Note that many settings are only available from the PC. For example the alarm rules can only be set at the PC as they are just too complex to set on a simple LCD.

Some calibration screens show the reading in the main edit box followed by the uncalibrated (raw) reading and then the percentage calibration that has been applied. This is useful when assessing the condition of a sensor. For example, if the reading appears incorrect, is this due to a faulty sensor or is the calibration a long way out.

Menu Structure

READINGS

- Nutrient Readings
- Media Readings
- Environment Readings
- Solar Readings
- Solar Trigger
- Alarm Status

SETTINGS

Calibrations

Cal Irrig sensors	EC sensor pH sensor
Cal Runoff sensors	EC sensor pH sensor
Cal Moisture sensors	Cal Offset factor (Zero with probe dry) Cal Scale factor (set 100% with probe wet) Moisture sensor selection <ul style="list-style-type: none">- 10HS- Echo 20- Echo 10- Echo 5- Green Probe (new slim probe)- CUSTOM (set all parameters) IF Custom selected (and saved) above Custom settings <ul style="list-style-type: none">- Power supply voltage for probe- Min input voltage (Dry)- Max input voltage (Wet)- Measurement (stabilize) time- Sample period(between samples)
Cal Solar Sensors	Total zero Total scale PAR zero point PAR scale
Clock	View time and date
Configure	Off-line log frequency Screen Contrast Comms address of MINDER

3. Calibration

Many of the sensors used with the MINDER do not require any calibration and the default calibrations should provide very accurate results. The sensors which do need initial calibration include EC, pH, moisture sensors and possibly the solar sensor. The EC sensors also require regular cleaning and the calibration of all sensors should be checked on a regular basis – perhaps monthly.

pH sensors

To calibrate pH, always calibrate in the pH7.0 buffer first and then, after rinsing and shaking off excess water, in the pH4.0 buffer. If the probe is faulty or if you place the probe in the wrong solution it will refuse to calibrate. To clean a pH electrode use a very soft toothbrush with a white kitchen cleaning paste (eg Jif) to gently scrub the glass bulb at the tip. Be very gentle as the bulb is easily broken.

EC sensors

To clean the EC probe, remove the shroud from the probe end and apply a white kitchen cleaning paste such as “Jif”. Rub, using the finger tip, in a circular motion to remove all signs of coating from the graphite electrodes. Rinse well with water and shake off excess. **DO NOT TOUCH WITH GREASY FINGERS OR CLOTH.**

To calibrate the EC probes, first clean and then place in the EC standard solution (2.764mS/cm or 27.64CF) allow plenty of time to temperature stabilize. The bigger the difference in temperature between the probe and the standard solution, the longer you need to wait.

Moisture sensors

First ensure that the correct sensor type is selected. If you wish to use a sensor type that is not listed, first check with Autogrow if this is possible and, if so, select CUSTOM. After saving this there will appear more menu items in the Cal moisture sub-menu. These allow you to set the power supply voltage required by the sensor, the voltages expected from the probe when dry and when wet and also the time needed for the reading to settle after applying power and also the interval between samples. These parameters are normally provided by the probe manufacturer. Having selected or set-up a custom probe it should be calibrated in the normal as follows:-

To calibrate the moisture probe, clean and dry the probe and dangle in the air away from any solid objects, then set the Zero Offset to read 00%. Next, immerse the probe in water and set the scale to read 100%.

Solar sensors

Solar calibration should be set by first covering the sensor to exclude all light and setting the zero point and then the scale can be set by comparison with an accurate calibrated meter. Alternatively, if a calibration factor has been supplied with the sensor this can be applied in the scale calibrate screen. Calibration of these sensors is not frequently required.

CO₂ sensors

These should be checked for calibration at least once per year by placing in fresh air for at least 5 minutes. They should then read between 350ppm and 410ppm depending on whether they are located in a rural or urban area. If calibration is required then refer to the appendices.

Fault correction

If calibration cannot be achieved try resetting to factory defaults as follows

- 4) Switch off power
- 5) Hold in both arrow buttons
- 6) Switch on power

This will delete all previously detected peripherals and will start a new detection search. Allow a minute or two for the search to complete.

Note that after doing this all settings, calibrations and alarms will need to be reinstated

If the EC sensors are ever replaced then you will either need to reset to defaults or else On the PC, type a single exclamation mark ! into the serial number field for the sensor and save this. The minder will then start a search for a replacement probe.

4. Maintenance

1) Periodically, check and clean all debris from the collection point funnels. How often this is needed will become apparent after a short time.

2) At least monthly, check the calibrations of all EC and pH sensors. The EC sensors should be cleaned and then tested for calibration. Normally, only cleaning is required and frequent recalibrations should not be needed. To clean the EC probe, remove the shroud from the end and run with a little white JIF (not lemon scented yellow JIF). If JIF is unavailable then use any plain mildly abrasive kitchen cleaner. Rub with circular motion and then rinse in clean water – do not touch with anything that could carry oil or grease. Even touching with the finger should be avoided as perspiration on the skin carries a small amount of oil.

After cleaning check the calibration using a Standard EC solution. Allow plenty of time for temperature compensation especially if the standard solution is at a different temperature to the probe.

3) pH electrodes have a limited life of between 6 months and three years. Replace them when they become slow or difficult to calibrate

4) Check calibration of moisture sensor

5) Wipe dust off the lens of solar sensors using a soft damp cloth

6) View all readings and consider if these look likely. If you suspect that any reading is inaccurate, compare it with an accurate hand held instrument. **Always shield a hand held sensor from solar radiation (direct and reflected)**

7) Check that the NutriSensor is in a dry position and all sensor cables or secured in a position where they are unlikely to be damaged

8) Fault correction

If calibration cannot be achieved or other problems are experienced, try resetting to factory defaults as follows

- 7) Switch off power
- 8) Hold in both arrow buttons
- 9) Switch on power

This will delete all previously detected peripherals and will start a new detection search. Allow a minute or two for the search to complete.

Note that after doing this all settings, calibrations and alarms will need to be reinstated

If the EC sensors are ever replaced then you will either need to reset to defaults or else On the PC, type a single exclamation mark ! into the serial number field for the sensor and save this. The minder will then start a search for a replacement probe.

5. Installation

Introduction – general comments

All electronic equipment will last longer if it is installed in a dry, cool shady location. Normally, an equipment 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 and severity 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.

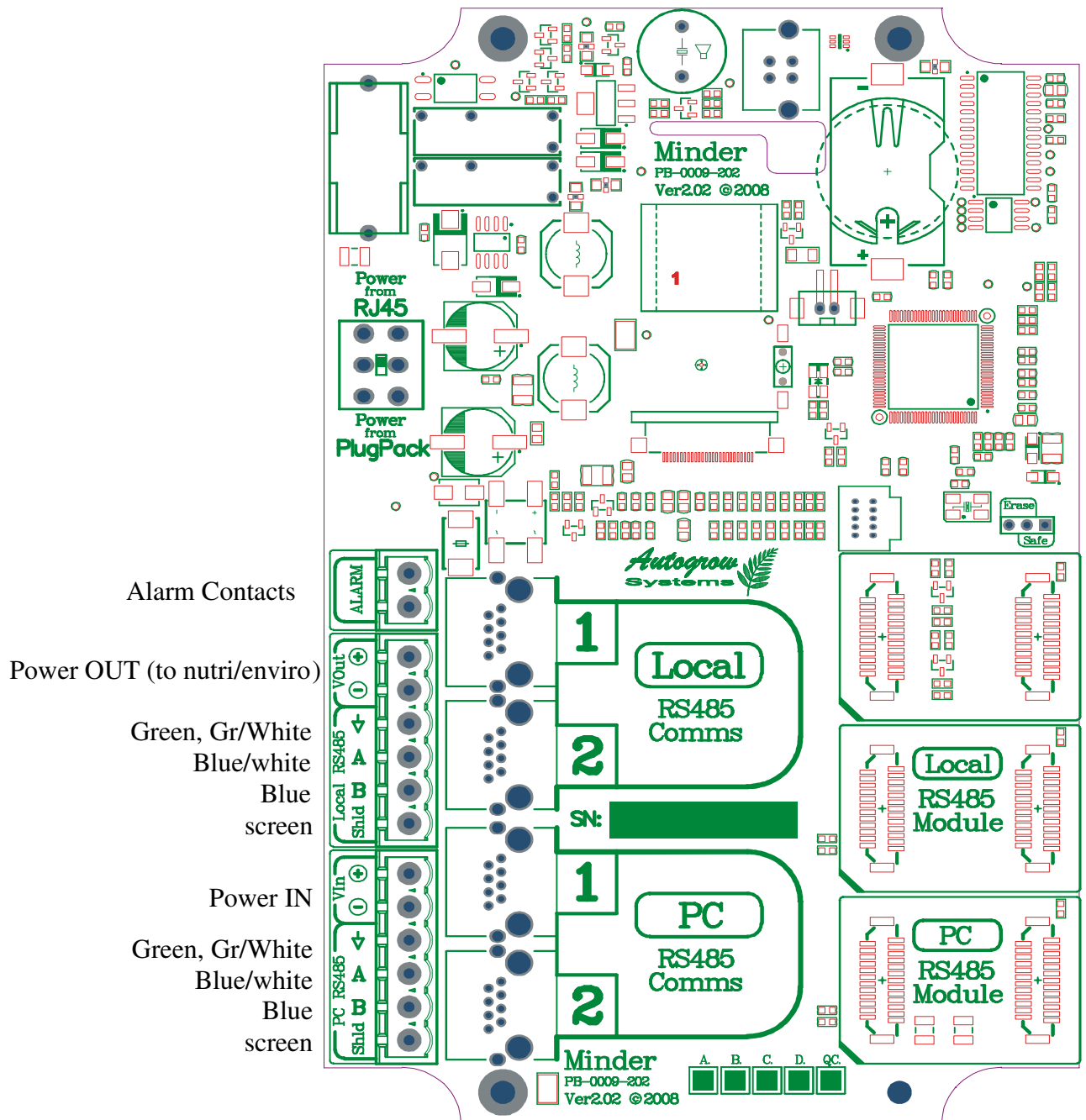
Use STRANDED CAT 5 (PATCH CABLE) for all data cabling and connections to remote sensors. The stranded CAT 5 cable is much less prone to breakage as compared with the more common solid style CAT5 cable. For the connection between the wind sensors and the weather station we recommend Marine Grade security cable.

Installing the MINDER controller

Fix the MINDER to a wall in a shaded, dry, cool position and run the cables through the gland in the bottom. It should not be installed in a high humidity propagation type house and in a regular greenhouse it is essential that it is well shaded from direct and reflected sunlight.

Position the Nutrient sensor connection box adjacent to the position of the run-off collection pots. The length of the leads on the sensors is approximately 1m. Preferably position the sensor box above floor level in a shady position where it is unlikely to get very wet. Although it is in an IP65 rated enclosure any small gaps where wires enter the box can allow water to enter. For this reason it is preferable to position it such that the sensor cables enter at the bottom.

The MINDER system is supplied with 5m CAT5 patch cables (these have RJ45 plugs molded on both ends) allowing very simple installation. These patch cables are available from computer stores in a wide range of lengths up to 50m and any length cable may be used. The MINDER system is also provided with RJ45 plug sockets to allow connections to enviro sensors and from MINDER to MINDER to be made using patch cables. When this is done power is conveyed along the patch cable from the first unit to subsequent units in the chain. Obviously, there is a limit on the number of minders that can be supplied in this way and this will depend on a number of factors such as power supply rating (Amps), what peripherals are connected to each minder eg Enviro sensors, solar sensors, CO2 sensors, number of moisture probes. A table is provided in appendix 1 to assist in calculating the maximum current draw. Current through patch cables should be limited to 400mA and so re-powering of the chain should be applied as required to ensure that this is not exceeded.



The main connections to the Minder are the two busses. The PC bus together with the power supply to the minder is at the bottom. Connection can either be via CAT5 patch cables which have molded on RJ45 plugs or it can be hard wired to the green connector on the left. Two RJ45 sockets are provided in order to allow daisy chaining to the next device. If there is no following device, ie this Minder is the final device on the daisy chain then a terminator should be plugged in. A slide switch at the top selects whether the Minder should get its power from the RJ45 patch cable or whether it is hard wired from a plug pack adapter. Normally the power adapter is 24VDC but any voltage from 12V to 24V AC or DC may be used.

A similar connection is provided for the “local” bus which is used to connect to the Minder’s peripherals such as the nutrient sensor box or the enviro sensor. Again, if one of these is not used then a terminator must be inserted. The terminator is simply an RJ45 plug with a short stub.

Finally, the two alarm contacts provide a voltage free contact that can be used to switch on a low voltage (max 24V) siren or strobe light. If a higher voltage is required then an external low voltage relay must be used.

Installing the Nutri- sensor box

Install the NutriSensor box off the floor so that it can never be swamped with water. Although it is water resistant, with so many cables entering the box it is unlikely to be completely water proof. Ensure that it is in a shaded position and is never left in direct sunlight. Normally the sensor box is installed 5m or so into a row and it is normally supplied with a 5m CAT5 patch cable to allow this. Note that it can be installed further away from the MINDER if a longer CAT5 patch cable is obtained (readily available from Computer stores). Power is provided to the NutriSensor via the CAT5 patch cable.

The sensors that connect into the sensor box have shorter cables to allow them to be positioned in the runoff collection boxes or in the media close to the sensor box.

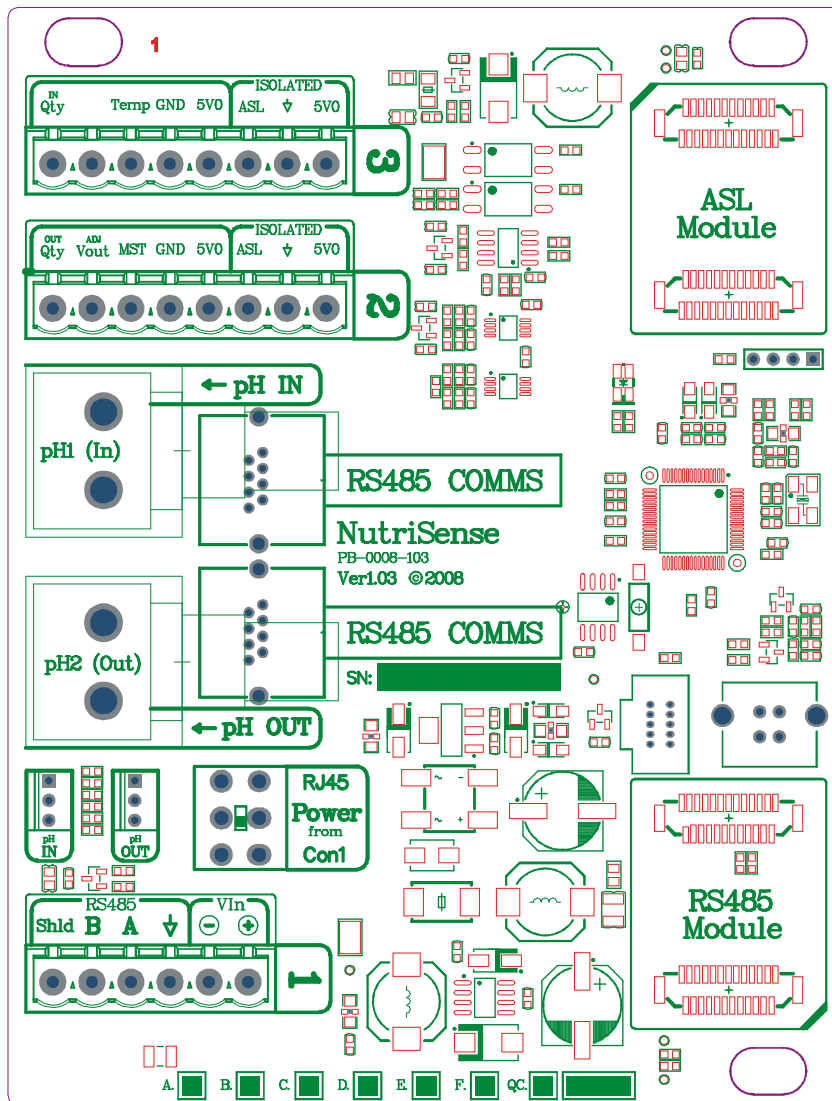
It is suggested that the moisture sensor is installed vertically in the media so that it registers an average moisture level as this varies over the depth of the media. If all probes are installed at the same depth and distance from the roots/dripper then comparison between measurement sites is more meaningful.



Enter the patch cables into the split gland seal from the side



Use the split rubber nipples provide a sealed entry for the pH cables



When a CAT5 patch cable is used to connect between the NutriSense and the Minder, the slide switch must be moved to the RJ45 position and the lower green connector will not be used. If the Minder is connected to the NutriSense by wired CAT5 cable then the Green, Green/white wires will connect to ground, the blue/white wire to A terminal, the blue wire to the B terminal and if the CAT5 cable is screened then the shield will connect to the shield terminal.

The upper two connectors are clearly labeled. The two ASL bus connections are both connected together - these are for connecting devices such as EC sensors, solar sensors and the ASL M2 moisture sensor. These devices are connected in parallel to either connector as follows:-

ASL devices eg solar sensor, ASL moisture probe

Red wire - 5V

Black wire – ground

White wire ASL

GREEN PROBE are connected:-

Bare wire – ground

Red wire – An/Vout

Black wire - MST

Decagon sensors are connected as follows:

Red - MST

White – An/Vout

Black (or silver screen) – Gnd

The ASL “E” probe is connected as follows:

Red – 5V

Black – GND

White – MST

Temperature sensor

Red – 5V

Black – Gnd

White - Temp

Quantity (tipping bucket) sensors are connected between Gnd and either the “In” or “Out” Qty terminals.

pH cables are to be pressed into the rubber grommets supplied and then run through the two grooves. When the lid is screwed down it should compress the rubber lead through to provide a water tight seal. If you have any doubts about this it may be advisable to use a small amount of RTV silicone sealant around the cable entry point.

EC sensor identification

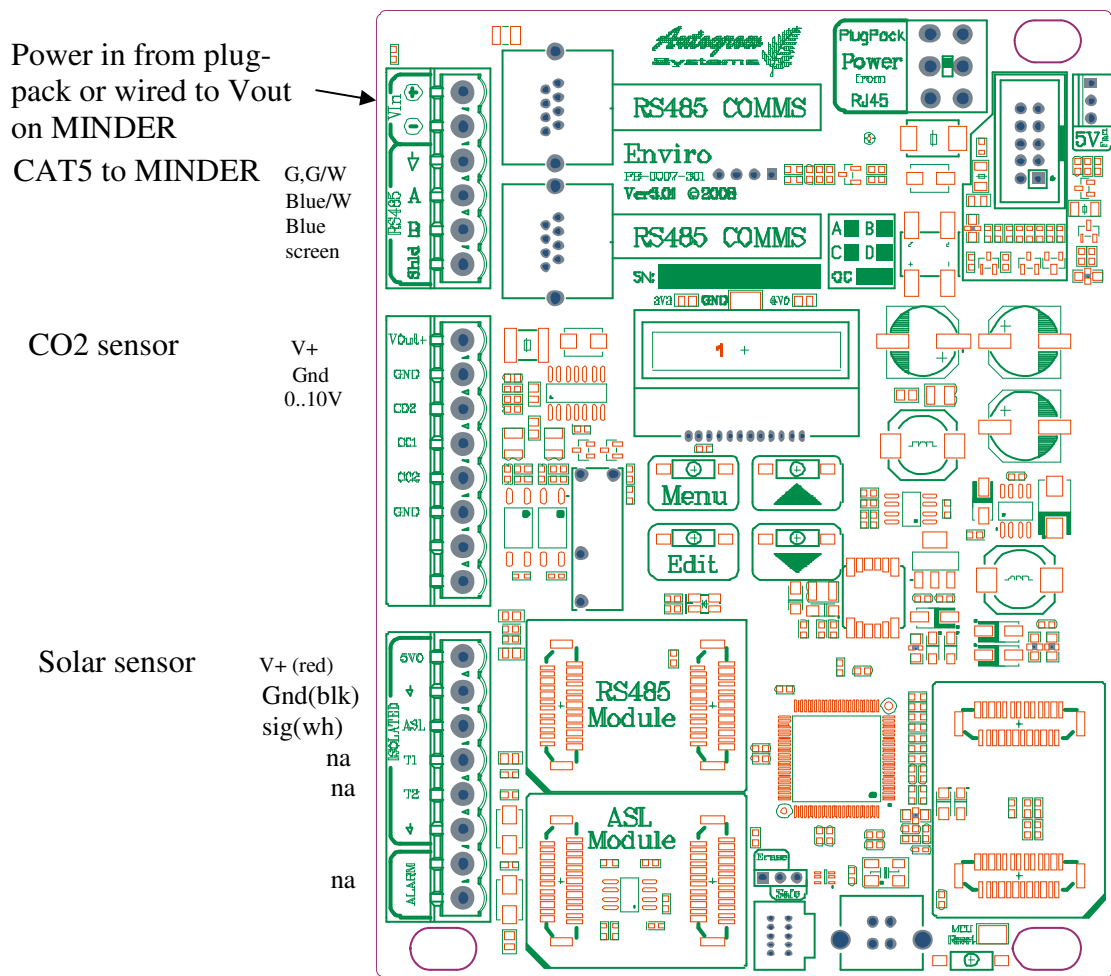
The two EC sensors are connected in parallel to the ASL bus connector and so when the system is first switched on the microcontroller will search for attached devices and will assign their serial numbers on a first found basis. This means that either of the two EC sensors could be assigned to be the irrigation EC sensor or the run-off EC sensor. To find out which is which place one in some EC solution and then look to see which one has a reading. If the reading appears as the irrigation EC then place this EC sensor in the irrigation collection point.

Installing the Enviro sensor

The Enviro Sensor 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. There are no settings required at the enviro sensor but the MINDER must be suitably configured to display the readings from the enviro sensor. A solar sensor (ASL bus type) may be connected to the enviro sensor.

Wiring connections to the Enviro sensor.

The simplest way to connect an Enviro sensor to the MINDER is by means of a CAT 5 patch cable. If this is done then the enviro sensor will obtain it's power from the MINDER over the patch lead. Alternatively, it may be hard wired using CAT5 stranded cable as shown below. Note that the power to the enviro sensor may be supplied over the CAT5 cable or locally from a plug pack.

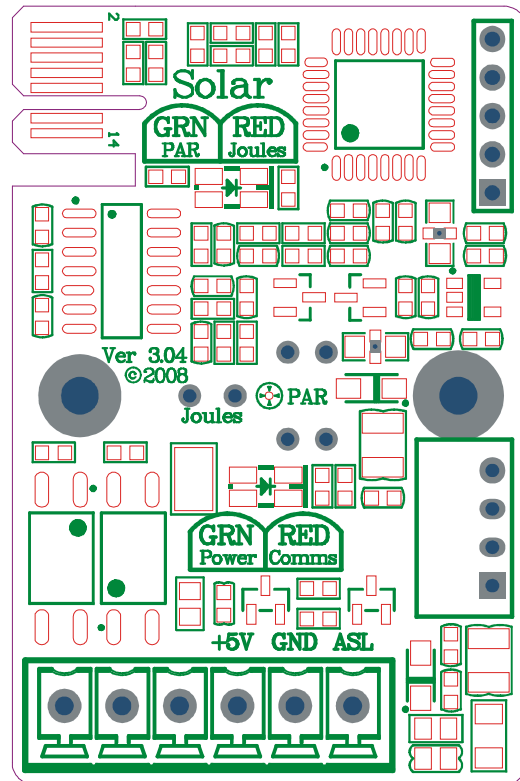


The enviro sensor has a small LCD inside the box which intended to aid with installation and setting up. By pressing the down arrow you can scroll through the readings as follows:- Air temperature, RH, Solar Total in Watts or Joules/sec/m2, Solar PAR in umol/m2, CO2 and finally the speed of the RS485 bus – This will show slow when connected to one of the older products such as an AV2 and fast when connected to a MINDER. By pressing the menu button to access the settings you can set the address of the enviro sensor. This is used where more than one enviro sensor is connected to a controller – for example, up to 4 enviro sensors may be connected to an AV2. To change an address, hold the set button pressed in and then press the up or down arrows to select either env1 (address 40), env2 (address 41), env3 (address 42), env4 (address 43). When the set button is released the current setting is saved in permanent memory.

Installing the Solar sensor

A solar sensor (ASL bus) may be connected to the runoff sensor box OR to an Enviro sensor box but **not both**. Position so that the opal lens is facing directly up. Do not slope it toward the sun. Ideally, the solar sensor should be positioned so that it received the same light as the crop. If this is inconvenient it may be positioned outside but in this case allowance must be made for shading due to the greenhouse skin and any shading material used. The solar sensor has two light sensors, one measuring PAR light and the other measuring total solar energy

Wire the solar sensor to the Enviro sensor using security cable



White
Black
Red

Communications modules.

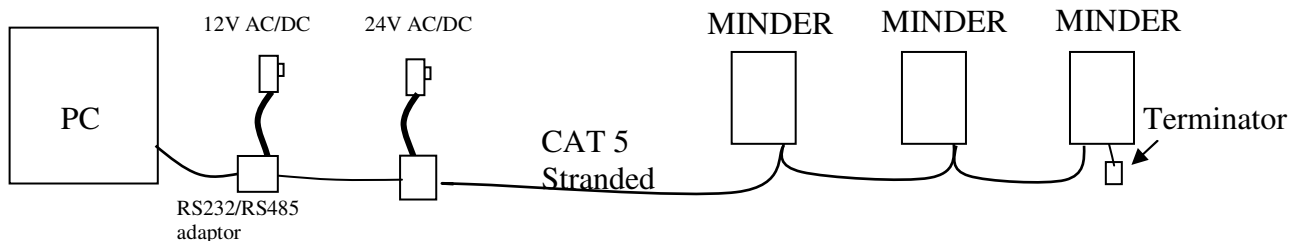
Communication cables between the various units are susceptible to nearby lightning strikes and for this reason small modular “daughter” boards are used. If damage is incurred from a lightning strike it is relatively easy to swap out the modules. The RS485 communications modules should self detect if they are faulty and after disconnecting themselves from the bus (so as not to interfere with other devices) a small LED on them will change from green to red.

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 9/12V AC or DC power. If the PC does not have a serial COM port then a USB to serial converter will also be required.

The connection between the PC interface box and the first device must be by means of a stranded CAT5 cable. This is most easily accomplished by using an Autogrow Surge Arrester / Break out box. This unit provides a simple way of applying power to the MINDERS via the CAT 5 and also provides improved lightning/surge protection to the bus. In fact we recommend fitting one of these in the PC comms bus after ever few devices (MINDERS/controllers) in order to help prevent a lightning surge from propagating along a bus and causing damage to many devices. If the Surge arrester box is used then a CAT5 patch lead with molded plugs may be used to link to the first MINDER in the chain.

Where possible use light coloured (so as not to attract heat) CAT5 stranded computer network cable. 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

Appendix 1 - Approximate current demand of various devices from 24DC supply

Minder	105mA
Nutrient sensor box	110mA
Solar sensor	20mA
Enviro sensor	100mA (incl fan and solar sensor)
CO2 sensor	100mA

Examples: When powering via RJ45 (patch lead) the maximum that can be powered are as follows using the key:- Minder = M, NutriSensor box with all sensors = NS, Enviro sensor with solar = ES. Patch cable has a published current limit of 400mA although it is probably Ok to exceed this a small amount as the MINDER system can tolerate large volt drops in the cable.

1 M + 1 NS + 1 ES + 1 CO2 OR 2M + 2NS

When powered via hard wired CAT5 cable (power lines doubled up) the maximum that can be connected is as follows:-

100m total length 4M + 4NS OR 4M + 4ES OR 2M + 2NS + 2 ES + 2CO2
(24V x 1.2A power supply required)

200m total length 2M + 2NS OR 2M + 2ES OR 1M + 1NS + 1 ES + 1CO2

300m total length 1M + 1NS + 1ES

400m total length 1M + 1NS OR 1M + 1ES
(24V x 0.5A power supply required)

For distances greater than these, the power would need to be run over heavy gauge wire to a point adjacent to the devices.

Appendix 2 Calibration and settings for the 8002-ACD sensor

- 1) **Calibrate** to ambient air (or calibrate against a known accurate hand-held CO2 meter).
Move the sensor into fresh air (ie outside or next to open window) and apply power – leave to settle for at least 5 minutes. Try not to breath too closely to the sensor.
Press “clear” and “enter” and hold for about 5 seconds. The screen will change to CAL AIR. Now press enter and you will enter the calibrate screen. Now press the up/dn rocker switch to make the displayed PPM to match the ambient value. If you have an accurate hand-held sensor then adjust the displayed PPM to read the same. If not then adjust to read 380ppm which is the typical ambient CO2 level. (If in the countryside away from all industry use 350 and if near a city or industrial area use 400ppm.
Press “enter” again and the instrument will self calibrate for about 5 minutes so that it will read the ambient CO2 level correctly. Again, do not breath near the unit while it is calibrating. At the end of calibration it will return to the normal readout screen.

- 2) To **change altitude** setting. The default setting is 0 ft above sea level. For good accuracy at higher altitudes you can enter the altitude of your position in feet (in steps of 500ft) above sea level.
Press and hold “clear” and “mode”, this will take you to the Altitude screen. Now press the rocker up/down key quite firmly to make it operate). Once the altitude is correct press “enter” to lock it in. This will return you to the “normal” display screen.

- 3) To **switch off ABC logic** (TEMA logic)
Press and hold “clear” and “mode”, this will take you to the Altitude screen. Now press “mode” once and you will be in the TEMA screen. This must be OFF for greenhouse operation. If ON, use the rocker key to turn OFF. Then press “enter” to save the setting. This will return you to normal screen

To change **CO2 range to 0 to 2000ppm**. For Autogrow climate controllers to work correctly, the CO2 sensor must be set so that 0 to 2000ppm corresponds to 0 to 10 Volts. The only exception to this is the IntelliClimate controller which may be switched to a range of 0..5000ppm for use in mushroom growing.

Press and hold “clear” and “mode”, this will take you to the Altitude screen. Now press “mode” key twice. You should see NONSTD. If not, press the rocker key through screens STDSET1 to STDSET9 until you get to NONSTD. Then press “mode” and you will see the low end of the measurement range – this should be 0ppm. Press “mode” again and you will see “To xxxxPPM”. Use the rocker key to make this 2000PPM and then press “enter” to save. Now press “mode” key repeatedly until you step through the complete menu and eventually return to the “normal” screen. On your way through the screens check that the voltage range is 0V to 10V.

Appendix 3 Warranty

The warranty on the MINDER, sensor box, enviro sensor box, solar sensors, EC sensors and temperature sensor is limited to 2 years – return to factory. Moisture sensors have a warranty period of one year and Sensors and peripherals, made by other manufacturers have warranties of lesser periods as provided by the particular manufacturer. In general, pH electrodes are limited to 6 months, temperature/RH sensors are limited to 1 year, rain gauges to one year, aspirating fans to one year and peristaltic pump rubber tubing has no warranty.

Before returning the unit for service you must call Autogrow Systems Ltd for a return authorization .

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.