MIST GUARD

Thermal Damage Controller

User / Installer Manual

for:

FrostGARD
HeatGARD
HeatGARD 10
PicoCLIMATE

Contents

Introduction

Every year growers suffer crop damage due to relatively brief extremes of temperature and humidity. Frost damage occurs at low temperature, when leaf cells freeze and rupture. Wilt damage occurs in hot, dry conditions, when plants become dehydrated due to excessive evaporation. Heaters or sprinklers may be installed to protect against extremes, but are useless if not activated in time, and costly and counter-productive if used unnecessarily.

MIST GUARD automates the task of monitoring temperature and humidity. When **MIST GUARD** preset thresholds are crossed, **MIST GUARD** raises an alarm. The alarm may use a solenoid or relay output to activate sprinklers, heaters or other protective equipment. **MIST GUARD** features:

- High accuracy, high stability temperature sensor
- Integrated humidity sensor shielded from rain and sunlight
- Pulse output to switch 2 or 3 wire DC solenoid or relay
- Configurable alarm temperature settings
- Logging for up to 20 alarm events, with time/date stamps
- Weatherproof enclosure with sealed cable entry
- High contrast display and large buttons
- Long operating life on ordinary alkaline AA batteries
- Hourly log of min & max temperature and humidity for last 24 hours

MIST GUARD can be set to operate in FrostGARD mode or in (standard or dual) HeatGARD mode. In FrostGARD mode, the alarm is activated when the temperature drops below a threshold. In standard HeatGARD mode, the alarm is activated when the temperature rises above a threshold. In dual HeatGARD mode, the alarm is activated when the temperature rises above a threshold or the humidity drops below a threshold. HeatGARD can be upgraded to “HeatGARD 10” to control multiple sprinklers using a ten output expansion board. By changing the alarm type for different seasons and perhaps different crops, **MIST GUARD** can be put to good use all year round. Simultaneously, **MIST GUARD** can also operate in PicoCLIMATE mode, to control ventilation and temperature for a greenhouse.

This manual describes how to install, configure and use **MIST GUARD** in all its modes. Take time now to familiarise yourself with all its features and settings. Read the entire manual before installing or using **MIST GUARD**. There is space at the end of the manual to record details of your installation.

How the Display and Buttons Work

MIST GUARD's screens are collected into eight menus, shown below the display: Humidity, Dew point, Temperature, Alarm, Log, Time, Date and Battery.

Normally you will be at the top of one of the menus:

Display icon	points to bullet to show which menu you are looking at (flashes other menus if something important is happening)
Display	shows information relevant to the menu
ENTER	enter into the menu to access its screens and settings
EXIT	usually does nothing
◀ and ▶	take you to the previous or next menu

To previous menu ◀ ▼ ▶ *To next menu*

Humid Dew Temp Alarm Log Time Date Batt

While inside a menu:

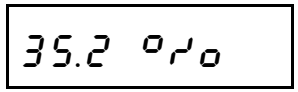
Display icon	is off. (May flash is important things are happening)
Display	shows a screen of relevant information or a user setting
ENTER	takes you to the next screen in the menu
EXIT	exits the menu
◀ and ▶	changes settings with each press (or hold to auto-repeat)

The Humidity Menu - monitoring the humidity

At any given temperature, air can contain a certain maximum amount of moisture as water vapour, called the saturation content. Relative humidity is the percentage of moisture in the air compared to the saturation content at the same temperature. When humidity reaches 100%, moisture condenses and dew or frost forms.

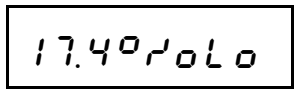
MIST GUARD measures humidity once each minute. Running high and low records are maintained, which may be cleared manually at any time.

The Humidity menu displays the current humidity:



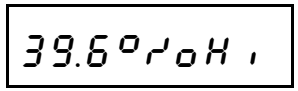
Press **ENTER** to access the other screens in the Humidity menu:

Lowest Humidity:



Press ◀ and ▶ at the same time to clear the lowest value (sets it to the current humidity)
Press **ENTER** to move to the next screen.

Highest Humidity:



Press ◀ and ▶ at the same time to clear the highest value (sets it to the current humidity)
Press **ENTER** or **EXIT** when finished.

The Dew Point Menu - monitoring the dew point

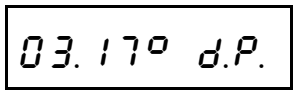
Cooling a body of air reduces the amount of moisture it can contain (saturation content) which in turn increases the relative humidity. Dew point is the temperature at which the humidity would reach saturation (100%). It is an absolute measure of the moisture content of the air, and is independent of the air temperature.

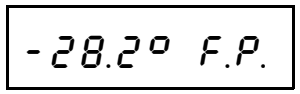
A dew point below 0°C is referred to as a frost point, because moisture condenses as ice rather than liquid water at that temperature. This term is not directly related to crop frost damage or to the temperature at which **MIST GUARD**'s alarm is activated.

MIST GUARD calculates the Dew point from the temperature and humidity, which are measured once each minute. Running high and low records are maintained, which may be cleared manually at any time.

The Dew point menu displays the current dew point (frost point):

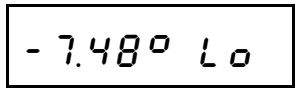
Current dew point: OR Current frost point:





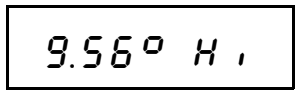
Press **ENTER** to access the other screens in the Dew point menu:

Lowest Dew point:



Press ◀ and ▶ at the same time to clear the lowest value (sets it to the current dew point) Press **ENTER** to move to the next screen.

Highest Dew point:

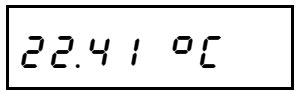


Press ◀ and ▶ at the same time to clear the highest value (sets it to the current dew point) Press **ENTER** or **EXIT** when finished.

The Temperature Menu - monitoring the temperature

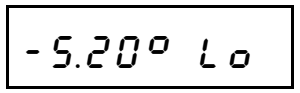
Temperature is measured once each minute. Running high and low records are maintained, which may be cleared manually at any time.

The Temperature menu displays the current temperature:



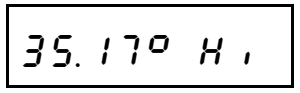
Press **ENTER** to access the other screens in the Temperature menu:

Lowest temperature:



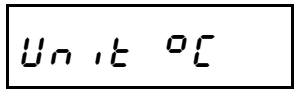
Press ◀ and ▶ at the same time to clear the lowest value (sets to the current temperature.) Press **ENTER** to move to the next screen.

Highest temperature:



Press ◀ and ▶ at the same time to clear the highest value (set to the current temperature.) Press **ENTER** to move to the next screen.

Set temperature units:



Press ◀ or ▶ to switch Celsius / Fahrenheit. All temperatures will be displayed in this unit Press **ENTER** or **EXIT** when finished.

The Log Menu - displaying the Event Log

The event log keeps a list of periods during which the alarm output was turned on automatically. It also stores the temperature and humidity that were measured at the start of the alarm period. See also page ? for more on alarm conditions. For Heat and Dual alarms with non-zero On pulse times, events are only logged when the temperature or humidity exceeds the threshold by 5°C or 5% respectively.

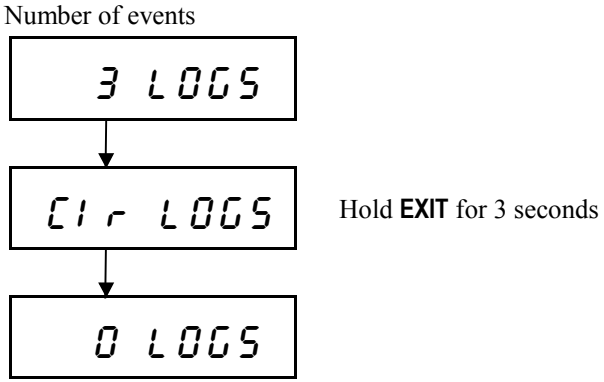
MIST GUARD can be left running unattended for long periods. Every so often, the log should be checked for any alarms that occurred since the last time it was inspected. Events can be noted in a table like the one on page 46:

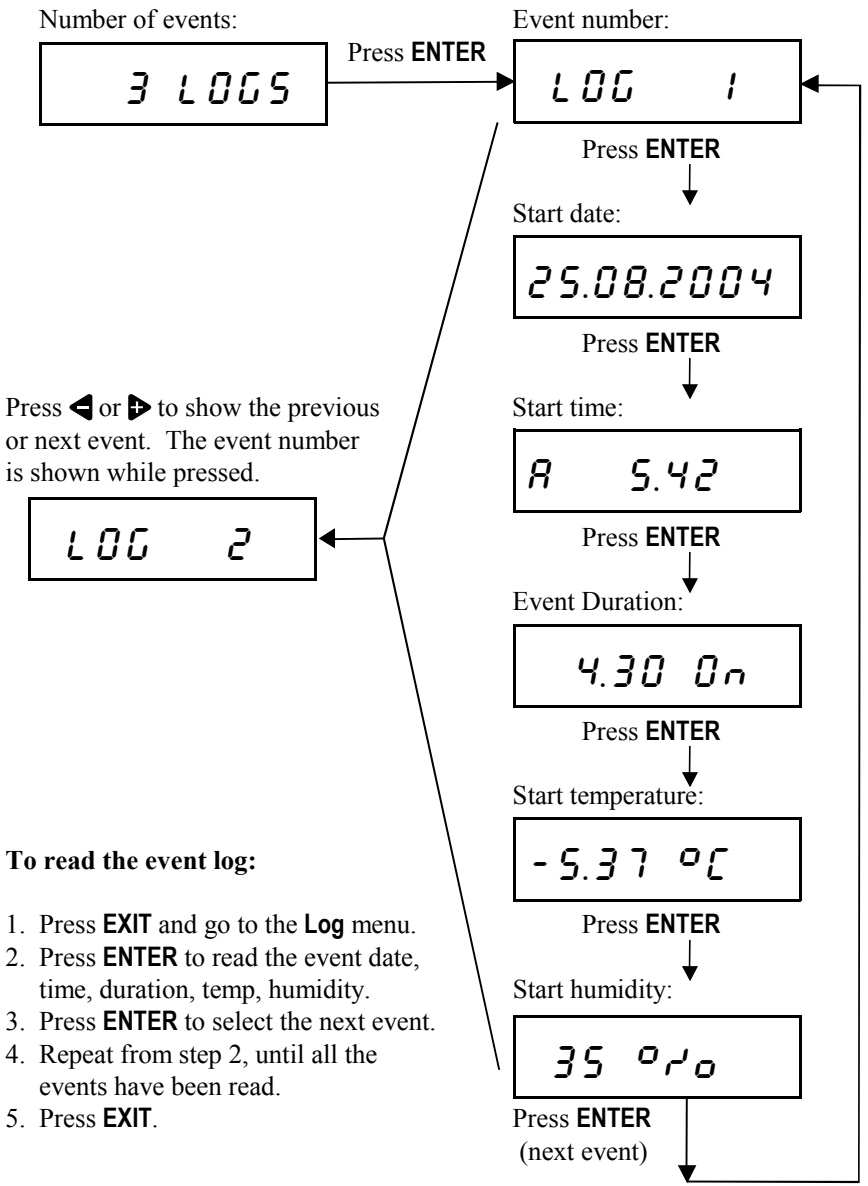
Start date	Start time	Duration	Temperature	Humidity
31/05/06	5:42 am	4:30	5.37 °C	35 %

Once the events have been noted, the log can be emptied ready to accumulate new events. **MIST GUARD** can hold up to 20 events. If more than 20 events accumulate, the oldest ones are overwritten first.

To clear the log:

Go to the **Log** menu and hold down the **EXIT** button for 3 seconds to clear all events from the log.





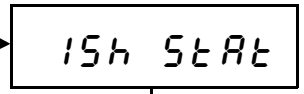
To read the event log:

1. Press **EXIT** and go to the **Log** menu.
2. Press **ENTER** to read the event date, time, duration, temp, humidity.
3. Press **ENTER** to select the next event.
4. Repeat from step 2, until all the events have been read.
5. Press **EXIT**.

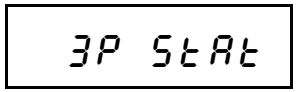
The Hourly Statistics Log

MIST GUARD maintains an Hourly Statistics Log covering the last 24 hours which contains the minimum and maximum values of temperature and humidity for each hour. To access the Hourly Statistics Log, go to the normal **Log** menu and hold down the **ENTER** button for 3 seconds. The Hourly Statistics Log always starts with the current hour.

Statistics log (24 Hr mode):



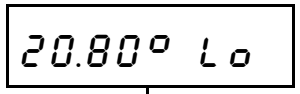
Statistics log (12 Hr mode):



Hourly Statistics for 3PM.

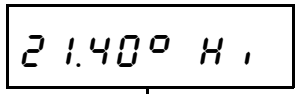
Press ◀ or ▶ to select the hour that you are interested in. ("StAt" flashes if you are at the current hour.) Press **ENTER** to view the stats.

Minimum Temperature:



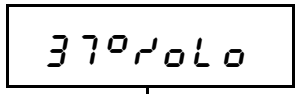
Lowest temperature for the relevant hour. ("Lo" flashes if you are at the current hour.) Press **ENTER** to move to the next display.

Maximum Temperature:



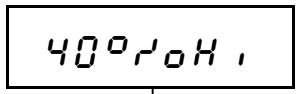
Highest temperature for the relevant hour. ("Hi" flashes if you are at the current hour.) Press **ENTER** to move to the next display.

Minimum Humidity:



Lowest humidity for the relevant hour. ("Lo" flashes if you are at the current hour.) Press **ENTER** to move to the next display.

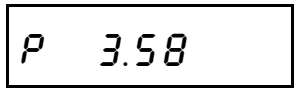
Maximum Humidity:



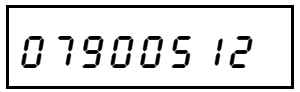
Highest humidity for the relevant hour. ("Hi" flashes if you are at the current hour.) Press **ENTER** to move to the previous hour.

The Time Menu - setting the time

The Time menu displays the current time:



Hold down the **EXIT** button to view the unit's Electronic Serial Number:

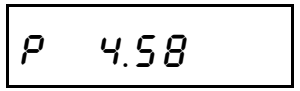


Note: all ESNs will be unique and may include letters or other characters.

Press **ENTER** to access the other screens in the Time menu:
Time format:

Press ◀ or ▶ to choose 12 or 24 hour mode. **MIST GUARD** will use this format whenever it displays a time. Press **ENTER** to continue.

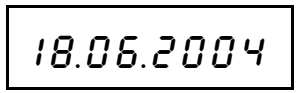
Set time:



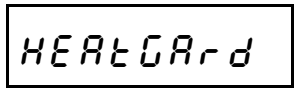
Use ◀ or ▶ to change the flashing number. Press **ENTER** to move to the next field. Press **EXIT** when finished.

The Date Menu - setting the date

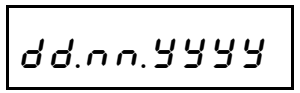
The Date menu displays the current date:



Hold down the **EXIT** button to view the unit's operating mode:

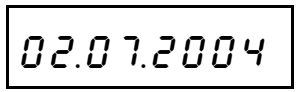


Press **ENTER** to access the other screens in the Date menu:
Date format:



Press ◀ or ▶ to change the date format. **MIST GUARD** will use this format whenever it displays a date. Press **ENTER** to continue.

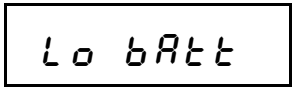
Set date:



Use ◀ or ▶ to change the flashing number. Press **ENTER** to move to the next field. Press **EXIT** when finished.

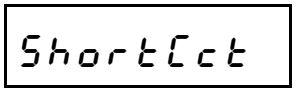
Error Messages

Press any button to clear an error message from the display.



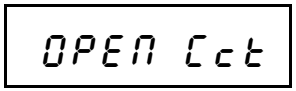
Low battery warning

The low battery warning message appears when the batteries are dangerously low. They should be replaced as soon as possible.



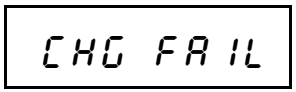
Solenoid short circuit

The short circuit error message appears when a short circuit across the solenoid wiring terminals is detected during firing. Check the connections, wiring and insulation. Check the output device setting (Solenoid / Relay / AquaNet) is correct (eg. as shown on page 23). Once the short circuit is removed, test the operation of the solenoid (eg. as described on page 23).



Solenoid open circuit

The open circuit error message appears when an open circuit across the solenoid wiring terminals is detected during firing. Check the connections, wiring and insulation. Check the output device setting (Solenoid / Relay / AquaNet) is correct (eg. as shown on page 23). Once the open circuit is removed, test the operation of the solenoid (eg. as described on page 23).



Charge failure

The charge failure message indicates that **MIST GUARD** was unable to build up enough charge to reliably fire the solenoid. This may occur as a result of very flat batteries. Replace the batteries and test the operation of the solenoid (eg. as described on page 23).

Installing MIST GUARD - Placement and Mounting

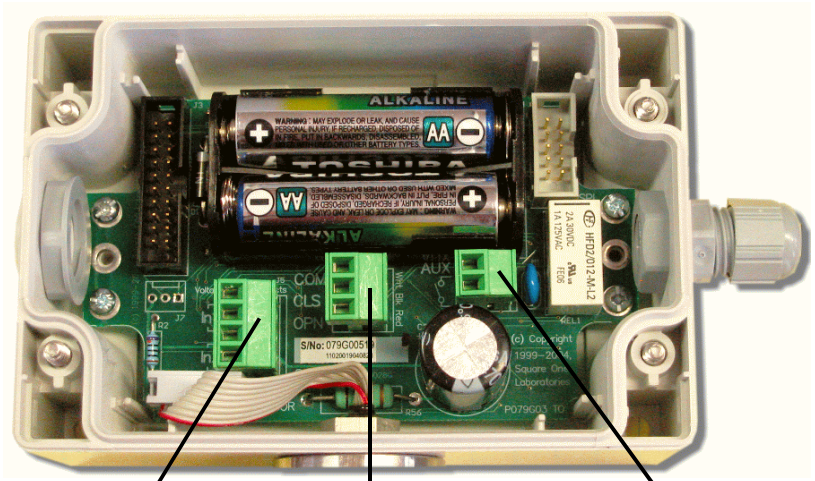
MIST GUARD should be installed so that it experiences the same temperature and humidity as the plants. Ideally, mount **MIST GUARD** onto a pole near or amongst the plants in the field, out in the open with plenty of free air-flow around the unit. **MIST GUARD** can be exposed to full weather, but would ideally be in a lightly shaded location (or would have a small roof over it) to prevent the temperature and humidity readings being affected by direct sunshine, rain and frost. Position **MIST GUARD** away from sprinklers and heat sources such as motors, water pipes, lights, direct or reflected sunlight, etc. Temperature and humidity sensors are on the bottom of the unit, surrounded by a metal cylinder for extra protection from direct sunlight and rain and damage. Avoid installing the unit close to the ground as heavy rain could cause mud to be spattered up over the sensors.

MIST GUARD is designed to be mounted to a metal plate on a pole using four screws or bolts (M4 or M5, or #8 self-tapping). Do not drill holes in the **MIST GUARD** case! Drill four suitable holes in the mounting plate with centres at the corners of a rectangle 106.0 mm wide x 65.5 mm high. Then use a small flathead screwdriver to gently lever off the two cover strips to the left and right of **MIST GUARD**'s front panel. Loosen all four posidrive screws and then open **MIST GUARD** - there are hinges on the right side. (The mounting holes are in the back panel, but the hinges cover two of the holes.) Remove the plastic hinges from the back panel by loosening the small screws using a small Philips screwdriver and then gently pulling up on the hinges. (If the hinges appear stuck, loosen the screws further and try again.) Mount to the plate using the four holes in the back panel, then put the hinges back in and retighten their screws. You are now ready to continue with installation.

Installation Checklist

- Read the entire manual
- Connect the output (eg. solenoid) Page 14
- Install AA batteries and set the date and time Page 15
- Test the output works properly (on and off) Page 17 / 23
- Make all relevant settings
- Set the alarm to automatic operation
- Test the system
- Clear the Log Page 8
- Record details of your equipment and your settings Page 47

Connecting to MIST GUARD



Two-wire solenoids use only the Red and Black terminals, and the White (common) is left empty. Three-wire solenoids use all three terminals. *MIST GUARD does not use the Digital inputs.*

The cable passes through the gland on the side of the case, which is sealed with a cap to protect the circuit board from dust and moisture.

1. Unscrew and remove the lid of the case.
2. Remove the gland cap and slide it onto the solenoid cable.
3. Feed the solenoid or relay cable through the gland into the case.
4. Locate the relevant screw terminals on the circuit board.
5. Connect the leads as shown above and tighten the screw terminals.
6. Slide the gland cap onto the gland and tighten it.
7. Install batteries (see page 15).
8. Set and test the solenoid / relay output device (see page 17 or 23).
9. Replace the lid and tighten the screws to seal the case.

Installing Batteries

Insert two AA-size long-life alkaline batteries into the battery holder, ensuring that the +/- polarity of each battery matches the markings inside the holder. MIST GUARD will then start up.

When MIST GUARD starts it displays "Frostie2" for five seconds, then it starts operating. It then prompts you to set the date format, the date and the time (see page 11) so that any new log entries will have the correct details.

The Battery Menu - checking the batteries

To check the battery level, press the ◀ or ▶ key until the display changes to the battery menu, as illustrated below. *Note: it may be necessary to press* EXIT *to exit another menu before you can change to the battery menu..*

Full batteries:	Low batteries:	Empty batteries:
E▮▮▮▮▮▮▮▮▮▮F	E▮▮▮▮ F	E F

If you hold down the EXIT button, MIST GUARD will display its version:

04.06.28.16

Using an external power supply

If you are using a MIST GUARD expansion board (eg. the ten output sequencer card) then MIST GUARD expects to get its power from an external power supply via the expansion board. MIST GUARD monitors the power supply and displays the "A.C. FAIL" error message if the external power supply is insufficient or not present. The battery display continues to monitor the battery level, but it also displays "A.C." when the external supply is working.

E▮▮▮A.C.▮▮ F Using A.C. supply (and it is working)

It is strongly recommended that you still install batteries in MIST GUARD so that data is not lost if the power supply fails: MIST GUARD will only use the battery if the external power fails or when the standard outputs turn on or off.

How to install and use FrostGARD

Overview

Frost damage occurs at low temperature, when leaf cells freeze and rupture. Humidity is also a major factor because the rate of evaporation of moisture from the plants increases as humidity decreases; this evaporation chills the plant below the air temperature and so the plant suffers frost damage at a higher temperature. **MIST GUARD** compensates for this chill factor.

Heaters or sprinklers may be installed to protect against frost damage. Frost sprinklers protect plants by covering the leaves in sheets of ice. Once frost sprinklers have been turned on, they should be kept on until the sun has melted all the ice from the plants. If not, the temperature of the ice and the leaves can quickly drop below the plant cell freezing point, perhaps causing more frost damage than if no protective sprinkling had been applied.

In automatic alarm mode, the alarm has two configurable timers that set the minimum amount of time for which the alarm output will stay on and off. The output will only change after a timer stops running and then only when alarm conditions change - it does not use the timers to turn on, off, on, etc while the alarm condition prevails. The on timer ensures the plants receive at least a specified amount of heat/sprinkling. The off timer ensures the plants and the heaters/sprinklers get a minimum rest between activation.

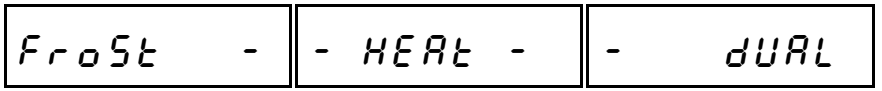
When operating heaters, the alarm On and Off times should be set to some small period, but large enough to prevent the heaters from being turned on and off too frequently. When operating frost sprinklers, the alarm On time should be set to a long period, perhaps 12 hours, to prevent interruption to water flow and to ensure the sprinklers do not turn off automatically before the crop has been inspected. (Once frost sprinklers have been turned on, they should be kept on until the sun has melted all the ice from the plants.) After the ice has melted, the sprinklers can be turned off manually - set the alarm mode to Off, then set it back to Auto ready for the next frost event.

The alarm has configurable temperature hysteresis. This puts a gap between the alarm off temperature and the alarm on temperature, so that the alarm output stays on long enough to have a measurable effect, rather than rapidly turning on and off. The alarm timers are usually more effective for this purpose, so set hysteresis to zero unless you specifically need hysteresis.

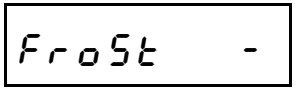
Installation for FrostGARD

First you must put **MIST GUARD** into FrostGARD mode:
Go to the **Alarm** menu and hold down the **EXIT** button for at least 3 seconds. **MIST GUARD** will display its current mode and will allow you to change it:

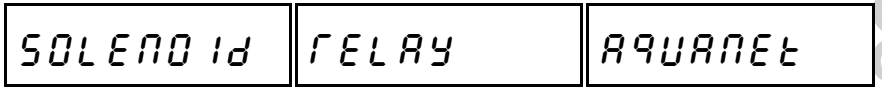
FrostGARD mode: HeatGARD mode: Dual HeatGARD mode



If necessary, use the ◀ or ▶ buttons to set **MIST GUARD** to FrostGARD mode:



After setting FrostGARD mode, press **ENTER** to view the current output device. Use the ◀ or ▶ buttons to change it. Press **ENTER** when done.

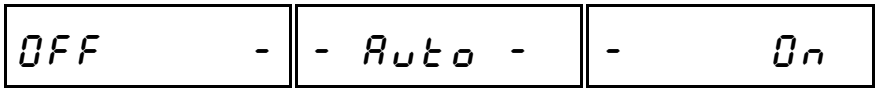


Note: the Aquanet setting is for solenoids which require more time than usual to activate. This setting will consume more battery power.

Testing The Alarm Output Device (solenoid or relay)

1. Go to the **Alarm** menu and press the **ENTER** button. **MIST GUARD** will display its current alarm mode: Off, Auto, or On.
2. To change alarm modes, hold down the ◀ or ▶ button for three seconds, until the new alarm mode display stops flashing.

Alarm Output Off: Alarm Auto mode: Alarm Output On:



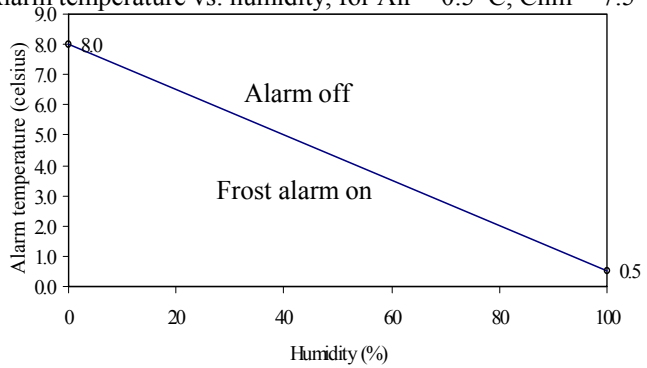
3. Swap between On mode and Off mode to force the alarm output to turn on or off. (It may take many seconds to build up enough charge to fire the output on or off, during which time you can press the **EXIT** button to watch the charge voltage as it reaches 12V. Then repeat from step 2.)
4. If **MIST GUARD** detects a wiring problem when firing the solenoid, it will display one of the error messages described on page 12. If so, check all connections or it might be necessary to change the Output Device (as shown above). Repeat testing until satisfied.

FrostGARD Settings

To configure the FrostGARD alarm settings:

1. Ensure that the Frost alarm is chosen, as shown on page 17.
2. Make sure you read and understand the Overview on page 16.
3. Go to the **Alarm** menu and press **ENTER** to skip the Alarm Status.
4. Press **ENTER** again to skip the Alarm mode.
5. Choose an alarm Air temperature that is just above the freezing point of your crop. (eg. if damage occurs at -0.5°C and you desire a 1.0°C safety margin, set the alarm Air temperature to 0.5°C.) Press ◀ or ▶ to set the alarm Air temperature. Press **ENTER**.
6. Choose an alarm Chill factor that matches the greatest temperature difference between the air and the plant cells, which will occur under dry conditions where evaporation is most rapid. (eg. a crop might become 7.5°C cooler than the air at 0% humidity, so the Chill factor would be set to 7.5°C. In our example this means that in very dry conditions the alarm will turn on at 8.0°C (0.5 + 7.5)). Press ◀ or ▶ to set the alarm Chill factor. Press **ENTER**.

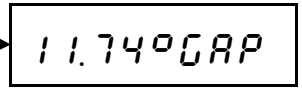
Alarm temperature vs. humidity, for Air = 0.5°C, Chill = 7.5°C:



7. Set the alarm output On time. Press ◀ or ▶ to choose from the built-in time periods (in hours and minutes). *Note: set to "0.00" to make the output turn off as soon as the alarm ends.* Press **ENTER**.
8. Similarly, press ◀ or ▶ to set the alarm Off time. Press **ENTER**.
9. Press ◀ or ▶ to set the temperature hysteresis. Press **ENTER**.

The FrostGARD Alarm Menu - monitor and set-up the alarm

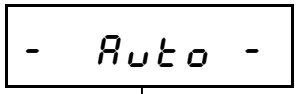
The FrostGARD Alarm menu displays the FrostGARD alarm status. See next page for more information on the FrostGARD Alarm Status display.



Hold **EXIT** to change alarm mode or to change output device. See page 17.

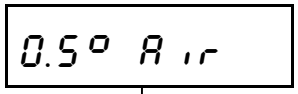
Press **ENTER** to access the other screens in the FrostGARD Alarm menu:

Alarm Mode:



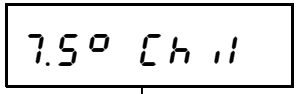
Hold ◀ or ▶ until the flashing stops to change alarm mode.
Press **ENTER** to move to the next screen.

Frost Air temperature:



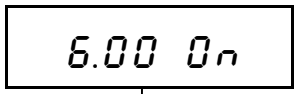
Use ◀ or ▶ to set the frost temperature that will trigger an alarm.
Press **ENTER** to move to the next screen.

Frost Chill factor:



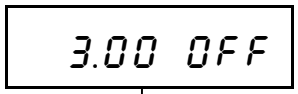
Use ◀ or ▶ to set the worst-case chill factor (the amount the plant temperature drops below air temp at 0% humidity).
Press **ENTER** to move to the next screen.

Minimum On time:



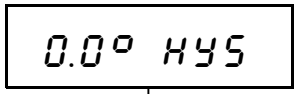
Use ◀ or ▶ to select a suitable alarm On time (in hrs.mins). Guarantees the output stays on for at least this long.
Press **ENTER** to move to the next screen.

Minimum Off time:



Use ◀ or ▶ to select a suitable alarm Off time (in hrs.mins). Guarantees the output stays off for at least this long.
Press **ENTER** to move to the next screen.

Temperature hysteresis:



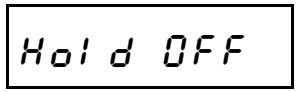
Use ◀ or ▶ to set the temperature hysteresis. Temperature must improve by this amount before alarm will cancel.
Press **ENTER** to exit the **Alarm** menu.

FrostGARD Alarm Status Display

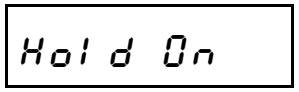
The FrostGARD Alarm display shows one of a number of messages, depending on the alarm mode and the current phase of operation of the alarm. The **Alarm** icon flashes whenever the alarm output is turned on.

If the alarm mode is set to a manual override (Off or On):

Alarm is held off:



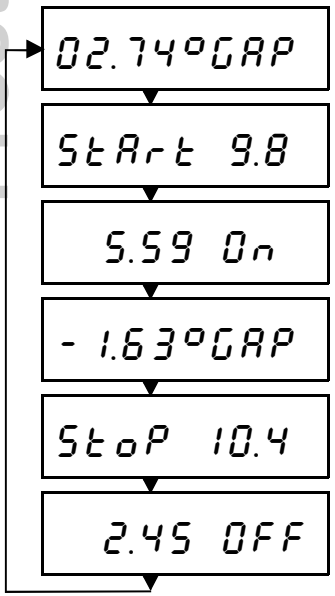
Alarm is held on:



If the alarm mode is set to Auto mode:

MIST GUARD will normally display the temperature margin - when it reaches 0° the alarm output switches on or off, and a start/stop voltage is shown as **MIST GUARD** charges up the energy required (around 12V) to fire the output. Then the output fires and the on/off timer countdown proceeds. When the timer expires, the display shows the temperature gap to the next change in alarm state. This cycle of the automatic alarm status is illustrated below.

Automatic Alarm status:



Temperature margin to alarm start.
(eg. alarm starts if temperature drops 2.74 °)

Monitors the voltage as it charges up, getting ready to turn the alarm output on. After the output turns on it starts the on timer.

Shows that the alarm output is On, and the time remaining in the On timer (in hh.mm).

Temperature margin to alarm stop.
(eg. alarm stops if temperature rises 1.63 °)

Monitors the voltage as it charges up, getting ready to turn the alarm output off. After the output turns off it starts the off timer.

Shows that the alarm output is Off, and the time remaining in the Off timer (in hh.mm).

Testing the FrostGARD installation

1. Check that **MIST GUARD** is in FrostGARD mode. Page 17
2. Check that the Output Device is correct. Page 17
3. Check that all FrostGARD settings have been made. Page 19
4. Set the Alarm mode to Auto. Page 17
5. Temporarily increase the Frost Air Temperature (page 18) above the current ambient temperature to start the alarm. Verify that the alarm output works satisfactorily. (Note: you may also want to temporarily reduce the On and Off times first.)
6. Restore the Frost Air Temperature to its proper setting. Either wait for the alarm to cancel (at the end of the On time) or else abort the alarm by setting the Alarm mode to Off and then return to Auto Alarm mode.
7. Clear the Log of any entries that have occurred. Page 8
8. Record your system settings, crop and hardware details. Page 47

How to install and use HeatGARD

Overview

Heat (wilt) damage occurs in hot, dry conditions, when plants become dehydrated due to excessive evaporation. Humidity is a factor because the rate of evaporation of moisture from plants increases as humidity decreases, increasing the plants' dehydration. **MIST GUARD** activates the alarm output to turn on sprinklers while the temperature exceeds a configurable threshold.

The Heat Air temperature setting is the temperature threshold at which the alarm output will turn on to control sprinklers, etc. It corresponds to very humid conditions, where there is no evaporation.

In standard HeatGARD mode, **MIST GUARD** uses the Dry factor setting and the measured humidity to reduce the temperature at which a Heat alarm will be triggered, to account for the increased rate of dehydration at low humidity. The Dry factor setting is the maximum amount by which the air temperature threshold would be reduced if the humidity were to reach 0%.

Dual HeatGARD mode attempts to keep both the temperature and humidity within certain limits, so it has a Humidity threshold setting instead of a Dry factor. If the temperature or humidity exceed their thresholds, the alarm is activated. The Heat Air temperature threshold is not adjusted for humidity.

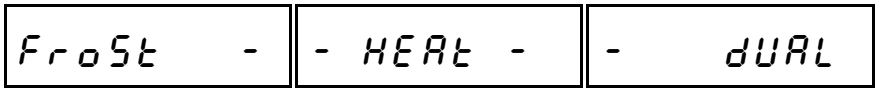
HeatGARD has configurable temperature hysteresis, and the Dual alarm also has configurable humidity hysteresis. The alarm conditions must improve by the set amounts for the alarm to end. This reduces frequent switching of the alarm output, although the alarm timers are generally more effective. Unless you specifically need hysteresis, set it to zero.

HeatGARD alarms have two timers (in seconds) which can be used to pulse a relay output at a constrained duty cycle and period. (This is useful for operating cooling or fogging sprays where large water drops forming from continuous use might induce harmful rotting.) The On timer sets a period after which the alarm will be turned off regardless of the temperature. **MIST GUARD** then idles for the Off period and then turns on again. When using a solenoid, these timers should be set greater than 60 seconds, due to the time and battery energy required to fire solenoids. An On time of zero means that the output will stay on for as long as the alarm condition is present.

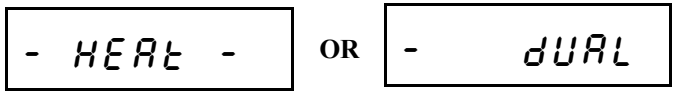
Installation for HeatGARD

First you must put **MIST GUARD** into your desired HeatGARD mode:
Go to the **Alarm** menu and hold down the **EXIT** button for at least 3 seconds. **MIST GUARD** will display its current mode and will allow you to change it:

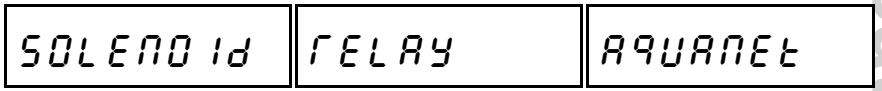
FrostGARD mode: HeatGARD mode: Dual HeatGARD mode



Use the ◀ or ▶ buttons to set **MIST GUARD** to your desired HeatGARD mode:



After setting FrostGARD mode, press **ENTER** to view the current output device. Use the ◀ or ▶ buttons to change it. Press **ENTER** when done.

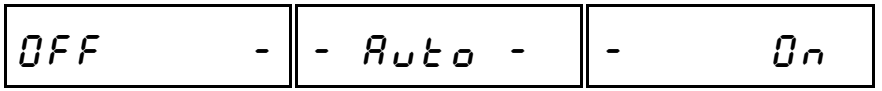


Note: the Aquanet setting is for solenoids which require more time than usual to activate. This setting will consume more battery power.

Testing The Alarm Output Device (solenoid or relay)

1. Go to the **Alarm** menu and press the **ENTER** button. **MIST GUARD** will display its current alarm mode: Off, Auto, or On.
2. To change alarm modes, hold down the ◀ or ▶ button for three seconds, until the new alarm mode display stops flashing.

Alarm Output Off: Alarm Auto mode: Alarm Output On:



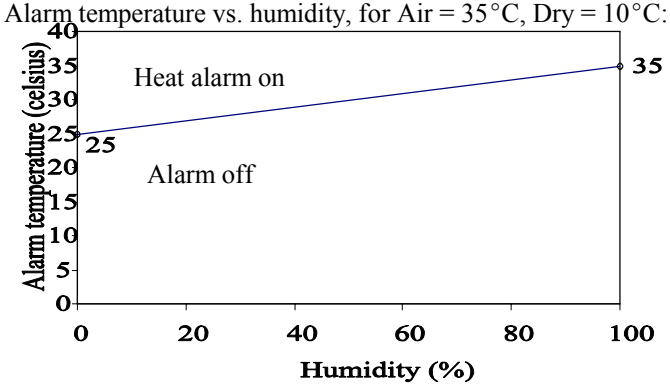
3. Swap between On mode and Off mode to force the alarm output to turn on or off. (It may take many seconds to build up enough charge to fire the output on or off, during which time you can press the **EXIT** button to watch the charge voltage as it reaches 12V. Then repeat from step 2.)
4. If **MIST GUARD** detects a wiring problem when firing the solenoid, it will display one of the error messages described on page 12. If so, check all connections or it might be necessary to change the Output Device (as shown above). Repeat testing until satisfied.

Standard HeatGARD Alarm Settings

To configure the standard HeatGARD alarm settings:

1. Ensure that the Heat alarm is chosen, as shown on page 23.
2. Make sure you read and understand the Overview on page 22.
3. Go to the **Alarm** menu and press **ENTER** to skip the Alarm Status.
4. Press **ENTER** again to skip the Alarm mode.
5. Choose an alarm Air temperature that is just below the hottest your crop can withstand in very humid conditions, i.e. at 100% humidity where there is no evaporation. This will be the highest temperature at which the Heat alarm will activate. (eg. 35°C) Press ◀ or ▶ to set the alarm Air temperature. Press **ENTER**.
6. Choose an alarm Dry factor that represents the difference in wilting temperature between very high and very low humidity. (eg. if the crop suffers wilting at 25°C in very dry conditions, the alarm Dry factor is 10°C (= 35 - 25))
   Press ◀ or ▶ to set the alarm Dry factor. Press **ENTER**.

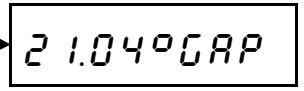
Alarm temperature vs. humidity, for Air = 35°C, Dry = 10°C:



7. Set the alarm output On time. Press ◀ or ▶ to set the alarm On time (up to 9999 seconds). *Note: if set to "0", the output stays on for as long as the alarm conditions persist.* Press **ENTER**.
8. Similarly, press ◀ or ▶ to set the alarm Off time. *Note: if set to "0", the output will recommence in the next minute.* Press **ENTER**.
9. Press ◀ or ▶ to set the temperature hysteresis. Press **ENTER**.

The HeatGARD Alarm Menu - monitor and set-up the alarm

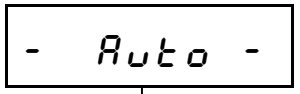
The HeatGARD Alarm menu displays the HeatGARD alarm status. See next page for more information on the HeatGARD Alarm Status display.



Hold **EXIT** to change alarm mode or to change output device. See page 23.

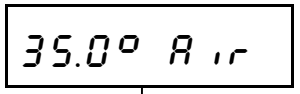
Press **ENTER** to access the other screens in the HeatGARD Alarm menu:

Alarm Mode:



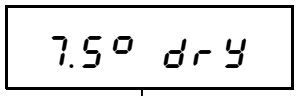
Hold ◀ or ▶ until the flashing stops to change alarm mode.
Press **ENTER** to move to the next screen.

Heat Air temperature:



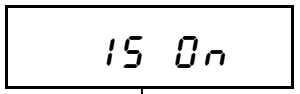
Use ◀ or ▶ to set the heat temperature that will trigger an alarm.
Press **ENTER** to move to the next screen.

Heat Dry factor:



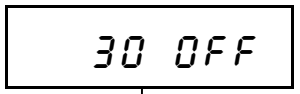
Use ◀ or ▶ to set the worst-case drying factor (the amount the plant temperature drops below air temp at 0% humidity).
Press **ENTER** to move to the next screen.

Pulse On time:



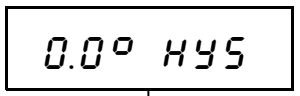
Use ◀ or ▶ to select a suitable alarm On time (in seconds). The output will always turn off after this time. *Note: On timer restarts when value is changed.*

Minimum Off time:



Use ◀ or ▶ to select a suitable alarm Off time (in seconds). Guarantees the output stays off for at least this long.
Press **ENTER** to move to the next screen.

Temperature hysteresis:



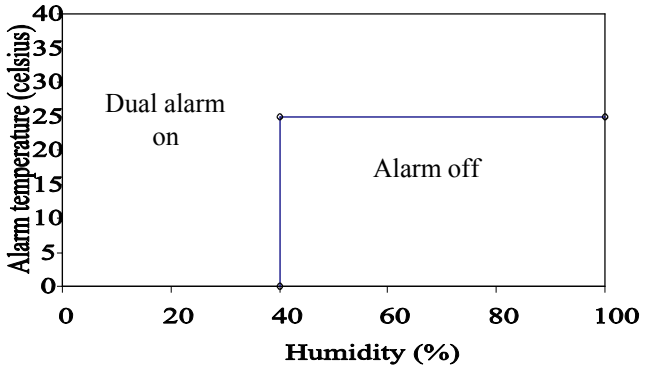
Use ◀ or ▶ to set the temperature hysteresis. Temperature must improve by this amount before alarm will cancel.
Press **ENTER** to exit the **Alarm** menu.

Dual HeatGARD Alarm Settings

To configure the Dual HeatGARD alarm settings:

1. Ensure that the Dual alarm is chosen, as shown on page 23.
2. Make sure you read and understand the Overview on page 22.
3. Go to the **Alarm** menu and press **ENTER** to skip the Alarm Status.
4. Press **ENTER** again to skip the Alarm mode.
5. Choose an alarm Air temperature that is the hottest you wish to tolerate. The Dual alarm will activate at temperatures above this threshold. For this example we have chosen 25°C. Press ◀ or ▶ to set the alarm Air temperature. Press **ENTER**.
6. Choose an alarm humidity threshold that is the driest you wish to tolerate. The Dual alarm will activate at humidities below this threshold. For this example we have chosen 40%. Press ◀ or ▶ to set the alarm Air temperature. Press **ENTER**.

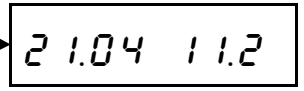
Alarm temperature vs. humidity, for Air = 25°C, humidity = 40%:



7. Set the alarm output On time. Press ◀ or ▶ to set the alarm On time (up to 9999 seconds). *Note: if set to "0", the output stays on for as long as the alarm conditions persist.* Press **ENTER**.
8. Similarly, press ◀ or ▶ to set the alarm Off time. *Note: if set to "0", the output will recommence in the next minute.* Press **ENTER**.
9. Press ◀ or ▶ to set the temperature hysteresis. Press **ENTER**.
10. Press ◀ or ▶ to set the humidity hysteresis. Press **ENTER**.

The Dual HeatGARD Alarm Menu - monitor and set-up the alarm

The Alarm menu displays the Dual HeatGARD alarm status. See next page for more information on the Dual HeatGARD Alarm Status display.



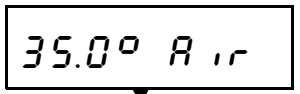
Hold **EXIT** to change alarm mode or to change output device. See page 23.

Press **ENTER** to access other screens in the Dual HeatGARD Alarm menu:

Alarm Mode:

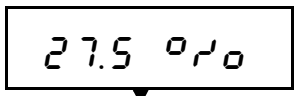
Hold ◀ or ▶ until the flashing stops to change alarm mode.
Press **ENTER** to move to the next screen.

Dual Air temperature:



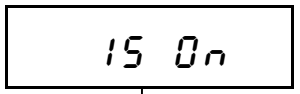
Use ◀ or ▶ to set the dual heat air temperature that will trigger an alarm.
Press **ENTER** to move to the next screen.

Dual Humidity:



Use ◀ or ▶ to set the dual heat humidity that will trigger an alarm.
Press **ENTER** to move to the next screen.

Pulse On time:

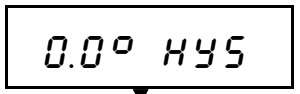


Use ◀ or ▶ to select a suitable alarm On time (in seconds). The output will always turn off after this time.

Minimum Off time:

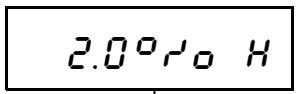
Use ◀ or ▶ to select a suitable alarm Off time (in seconds). Guarantees the output stays off for at least this long.

Temperature hysteresis:



Use ◀ or ▶ to set the temperature hysteresis. Temperature must improve by this amount before alarm will cancel.

Humidity hysteresis:



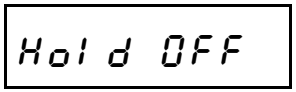
Use ◀ or ▶ to set the humidity hysteresis. Humidity must increase by this amount before alarm will cancel.
Press **ENTER** to exit the **Alarm** menu.

HeatGARD Alarm Status Display

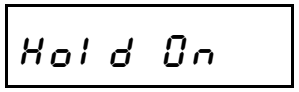
The Alarm display shows one of a number of messages, depending on the alarm mode and the current phase of operation of the alarm. The **Alarm** icon flashes whenever the alarm output is turned on.

If the alarm mode is set to a manual override (Off or On):

Alarm is held off:



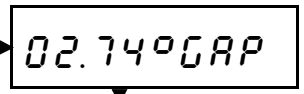
Alarm is held on:



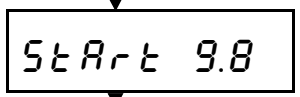
If the alarm mode is set to Auto mode:

MIST GUARD will normally display the temperature margin - when it reaches 0° the alarm output switches on or off, and a start/stop voltage is shown as **MIST GUARD** charges up the energy required (around 12V) to fire the output. Then the output fires and the on/off timer countdown starts. When the timer ends, the display shows the temperature gap to the next change in alarm state.

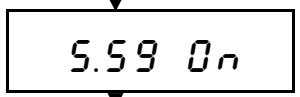
Automatic Alarm status:



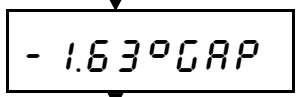
Temperature margin to alarm start.
(eg. alarm starts if temperature drops 2.74 °)



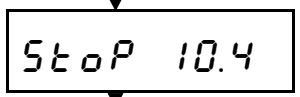
Monitors the voltage as it charges up, getting ready to turn the alarm output on. After the output turns on it starts the on timer.



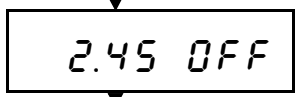
Shows that the alarm output is On, and the time remaining in the On timer (in hh.mm).



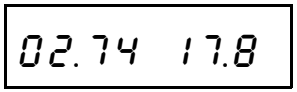
Temperature margin to alarm stop.
(eg. alarm stops if temperature rises 1.63 °)



Monitors the voltage as it charges up, getting ready to turn the alarm output off. After the output turns off it starts the off timer.



Shows that the alarm output is Off, and the time remaining in the Off timer (in hh.mm).



In Dual mode, temperature margin (°) is on the left, humidity margin (%) on the right.

Testing the HeatGARD installation

1. Check that **MIST GUARD** is in HeatGARD mode. Page 23
2. Check that the Output Device is correct. Page 23
3. Check that all HeatGARD settings have been made. Page 25 / 27
4. Set the Alarm mode to Auto. Page 23
5. Temporarily decrease the Heat Air Temperature (page 25 or 27) below the current ambient temperature to start the alarm. Verify that the alarm output works satisfactorily. (Note: you may also want to temporarily reduce the On and Off times first.)
6. Restore the Heat Air Temperature to its proper setting. Either wait for the alarm to cancel (at the end of the On time) or else abort the alarm by setting the Alarm mode to Off and then return to Auto Alarm mode.
7. Clear the Log of any entries that have occurred. Page 8
8. Record your system settings, crop and hardware details. Page 47

How to install and use HeatGARD 10

Overview

This section should be used in conjunction with the standard HeatGARD section of this manual. Please read the entire manual before installing.

HeatGARD 10 is a variation of HeatGARD that can drive up to ten alarm output devices using the ten output expansion board. This enables **MIST GUARD** to drive up to ten water valves in a rotating sequence for installations where sufficient water pressure may not be available to operate all sprinklers or sprays simultaneously. HeatGARD 10 can operate in standard HeatGARD mode or Dual HeatGARD mode, as described in previous sections.

The On and Off time settings are the only settings that have altered meaning when the ten output sequence board is selected. When the alarm starts, the pump (if available) is turned on. Two seconds later, each valve output (up to the number configured) is activated in turn for the On time period (in seconds). Next the sequence pauses for the Off time period, with the relief valve (if available) turned on. The sequence repeats from valve output 1 for as long as the alarm continues. For example, if sequencer is set to use 3 outputs with alarm On time of 1 second and alarm Off time of 60 seconds, the ten output sequencer board will behave in the following manner:

Valve 1 on for 1 sec.
Valve 2 on for 1 sec.
Valve 3 on for 1 sec.
Relief (valve 9) on for 60 seconds.
Repeat if the alarm is still required.

Valve outputs 9 and 10 have alternative uses: when fewer than 9 outputs are used, output 9 is used as the relief valve output, active whenever no other valves are active, to relieve water pressure build-up. When fewer than 10 outputs are used, output 10 is used as the pump output, active whenever **MIST GUARD**'s alarm is raised. This may be used to switch a mains voltage relay.

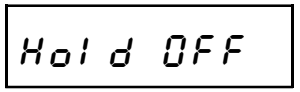
The ten output sequence expansion board requires an externally fused 24V AC supply to operate, and switches 24V AC to each output terminal in turn. When powered externally **MIST GUARD** draws no current from its batteries. If power fails **MIST GUARD** will continue to operate from battery power, but the expansion board will cease to function until power returns.

HeatGARD 10 Alarm Status Display

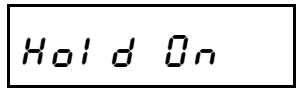
The HeatGARD 10 Alarm display shows one of a number of messages, depending on the alarm mode and the current phase of operation of the alarm. The **Alarm** icon flashes whenever the alarm output is turned on.

If the alarm mode is set to a manual override (Off or On):

Alarm is held off:



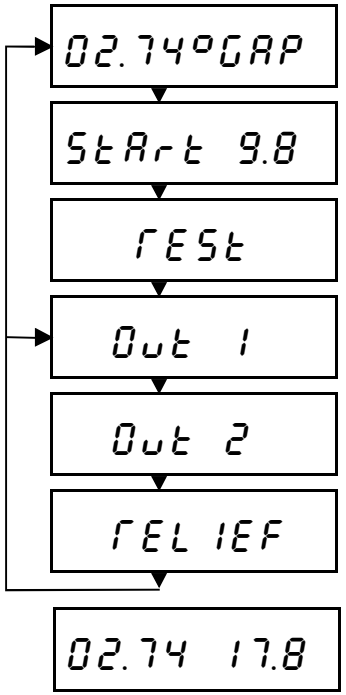
Alarm is held on:



If the alarm mode is set to Auto mode:

MIST GUARD will normally display the temperature margin - when it reaches 0° the alarm process starts, and a start voltage is shown as **MIST GUARD** charges up the energy required (around 12V) to fire the standard alarm output. The output is only on for 2 seconds and then the ten output sequence starts. When the alarm ends, the display returns to show the temperature margin.

Automatic Alarm status:



Temperature margin to alarm start.
(eg. alarm starts if temperature drops 2.74 °)

Monitors the voltage as it charges up, getting ready to turn the standard alarm output on.

The standard alarm output is turned on for 2 seconds and then turned off.

Sequencer output 1 is turned on for the alarm On time and then turns off.

Sequencer output 2 is turned on for the alarm On time and then turns off.
All other enabled outputs follow in sequence.
Then the Relief valve is turned on for alarm Off time and then turns off. Loops back to output 1 again, or shows Gap if alarm ends.

In Dual mode, temperature margin (°) is on the left, humidity margin (%) on the right.

Installation of HeatGARD 10

First you must put **MIST GUARD** into your desired HeatGARD mode and then set it to use the ten output sequence device:
Go to the **Alarm** menu and hold down the **EXIT** button for at least 3 seconds. **MIST GUARD** will display its current mode and will allow you to change it:

FrostGARD mode: HeatGARD mode: Dual HeatGARD mode

FroSt -	- HEAt -	- dUAL

Use the ◀ or ▶ buttons to set **MIST GUARD** to your desired HeatGARD mode:

- HEAt -	**OR**	- dUAL

After selecting a HeatGARD mode, press **ENTER**:

Current Output Device:

SEQUENCE

Use the ◀ or ▶ buttons to select the ten output sequence board. Then press **ENTER**.

Sequence Length:

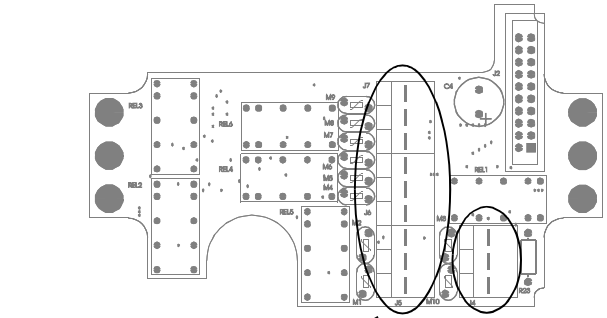
10 Out

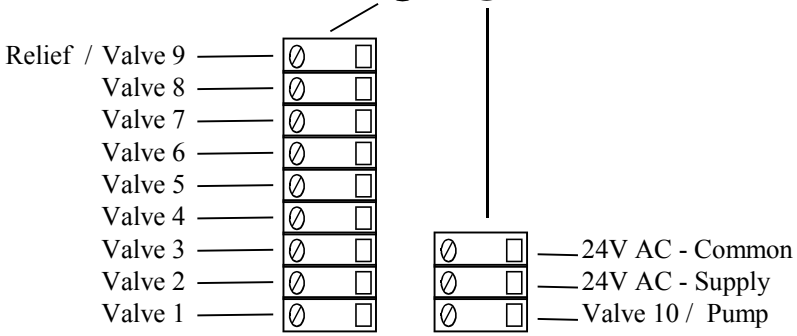
Use the ◀ or ▶ buttons to select the number of sequence outputs that you wish to use. Press **ENTER** when done.

Installing the ten output sequence expansion board

1. Remove the panel cover strips from the **MIST GUARD** unit. Unscrew and remove the cover. Remove the batteries.
2. Use the four screws provided to attach the expansion board to the mounting posts inside the back cover.
3. Unscrew and remove the blanking plug from the side of the **MIST GUARD** unit. (Retain this plug.) Firmly attach the large cable entry gland provided in place of the blanking plug.
4. Slide the gland cap over the end of the multi-core cable and insert the cable through the gland.
5. Strip 100mm of the outer sheath from the cable. Strip 10mm of insulation from each conductor.

6. Attach each conductor to its screw terminal on the expansion board, as shown on the following diagram.
7. Firmly attach the ribbon cable from the expansion board to the shrouded header on the **MIST GUARD** board.
8. Insert the two plastic hinges inside the corners of the case and cover.
9. Fasten the hinges with the four countersunk screws. Don't over-tighten.
10. Apply power via the multi-core cable to the leads marked 24VAC and Common on the following diagram.
11. Ensure **MIST GUARD**'s display is operating normally. Replace the batteries.
12. Close the unit, taking care that no cables are caught in the case seal.
13. Tighten the case screws and replace the cover strips on the panel.
14. Tighten the cable entry gland cap.





Use 12-core unshielded cable to connect to an external junction box.
Connect one lead of each output device to 24V AC Common.
Each output is rated at 1A max.
Valve outputs 9 and 10 have alternative uses: see page 30.

Testing the HeatGARD 10 installation

1. Check that **MIST GUARD** is in HeatGARD mode. Page 32
2. Check that the Output Device is set to Sequence. Page 32
3. Check that all HeatGARD settings have been made. Page 25 / 27
4. Set the Alarm mode to Auto. Page 32
5. Temporarily decrease the Heat Air Temperature (page 25 or 27) below the current ambient temperature to start the alarm. Verify that all the alarm outputs work satisfactorily. (Note: you may want to temporarily reduce the On and Off times first.)
6. Restore the Heat Air Temperature to its proper setting. Either wait for the alarm to cancel (at the end of the On time) or else abort the alarm by setting the Alarm mode to Off and then return to Auto Alarm mode.
7. Clear the Log of any entries that have occurred. Page 8
8. Record your system settings, crop and hardware details. Page 47

How to install and use PicoCLIMATE

Overview

PicoCLIMATE is designed to regulate temperature inside a greenhouse by controlling the amount of ventilation available to the cooler outside world. It does this by monitoring the internal air temperature and then opening or closing vents to increase or reduce the airflow. PicoCLIMATE waits for a user-defined period of time after each change for the temperature to respond. Only then will it adjust the ventilation further, if necessary.

PicoCLIMATE has two modes of operation. In Group mode all the vents are changed together - this gives quick response to changes fairly evenly across the whole greenhouse, but only has a few settings between closed and open. In Cascade mode only one vent is changed at any time - this gives finer control of the ventilation, but takes longer for large adjustments.

For complete control, the user may manually lock or change any or all vents in the system. This is useful if some areas in the greenhouse are unused or damaged or need to be at a different temperature, or if some vents are exposed to excessive or unwanted wind or rain or noise, or in emergencies.

PicoCLIMATE also has an alarm function which logs extreme temperature periods. It can also activate the “Close vent 5 / Alarm” relay contact alarm output (for driving sirens, warning lights, etc) if fewer than five vents are connected.

Vents should be fitted with stepper motors so that PicoCLIMATE can set each vent to any aperture from fully closed to fully open. To counteract any errors which may accrue with time, it can automatically recalibrate the system several times each day. (This involves fully closing the vents to the “Stop” and then returning the vent to its previous position.)

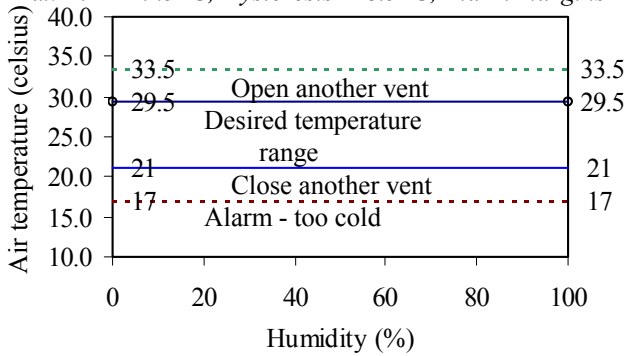
The ten output expansion board is required, and it enables **MIST GUARD** to control the ventilation for up to five vents. Two relay contacts are used to drive a stepper motor for each vent - one to open and one to close the vent.

NOTE: While in PicoCLIMATE mode, MIST GUARD can simultaneously operate in FrostGARD or HeatGARD mode, (but not HeatGARD 10 mode, since PicoCLIMATE needs the ten output sequence expansion board).

PicoCLIMATE Settings

1. Make sure you read and understand the Overview on page 35.
2. Go to the **Alarm** menu
3. Hold down the **ENTER** button to access PicoCLIMATE menu.
4. Use ◀ or ▶ to turn PicoCLIMATE On. Press **ENTER** twice.
5. Press **ENTER** to skip the PicoCLIMATE status screen, or use ◀ or ▶ to manually override any or all of the vents. (See page 40.)
6. Use ◀ or ▶ to set the Maximum Air temperature that is the hottest you wish to tolerate. (eg. 29.5°C). If temperature exceeds this maximum, PicoCLIMATE will open vents to increase ventilation. Press **ENTER**.
7. The Minimum Air temperature is not set explicitly, instead you set the Temperature Hysteresis (eg. 8.5°C) to specify the desired operating range, so the minimum = maximum - hysteresis (eg. 21°C). While the temperature is below the minimum, PicoCLIMATE will close vents to reduce the ventilation. Press ◀ or ▶ to set the Hysteresis. Press **ENTER**.

eg. Max Air = 29.5 ºC, Hysteresis = 8.5 ºC, Alarm margins = 4 ºC:

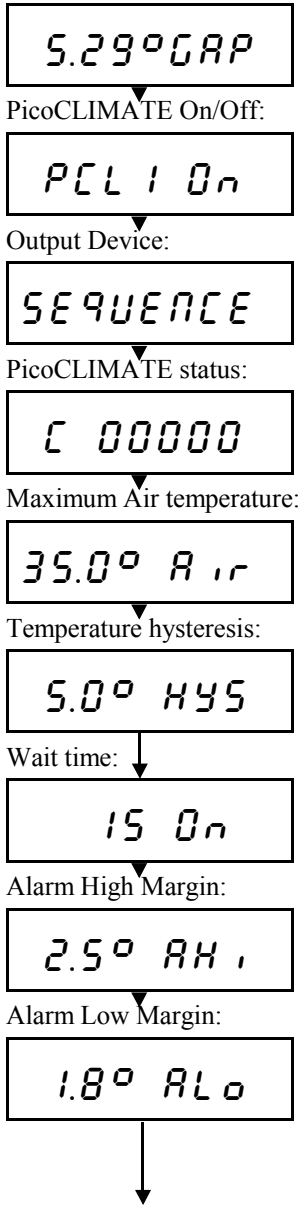


8. After each vent change, PicoCLIMATE waits before making any more changes to the vents. Press ◀ or ▶ to set the Wait time (10 - 600 secs). It should be large enough for the change to have had its effect on the temperature. If it is too long, the system is too slow to respond to rapid temperature changes and can easily lead to alarm conditions; if it is too short then PicoCLIMATE can over-compensate and might cause large temperature swings. Press **ENTER**.
9. Choose Alarm High and Low Margins. If temperature exceeds the desired range by either margin (eg. 4°C) the alarm will be Logged and an alarm output can be activated. The Alarm remains in effect until the temperature is back within the margins by 1°C. Use ◀ or ▶ to set the High margin. Press **ENTER**. Do the same for the Low margin.

10. PicoCLIMATE controls vent opening by activating the Open & Close outputs for accurate periods of time. To counteract any errors which may accrue with time, it can automatically recalibrate the vents. (To do this it fully closes vents to the "Stop" and then returns the vents to their positions.) Press ◀ or ▶ to set the Recalibration Rate = the number of times to recalibrate each day, synchronised to midnight. Press **ENTER**.
11. Press ◀ or ▶ to select the desired PicoCLIMATE mode. Group mode changes all the vents together (eg. all vents go from Closed to position 1) - this gives a quick response and it changes ventilation evenly over the whole greenhouse, but only has a few settings between closed and open. In Cascade mode only one vent is changed at any time - this gives finer ventilation control, but may take longer to adjust because of the wait time between each vent change. Cascade can lead to small localised warm or cool spots since low-numbered vents will be open sooner and more often, thus they will be cooler. Press **ENTER**.
12. Use ◀ or ▶ to set the Number of Vents to be controlled, up to five. Press **ENTER** to start making settings for each of the vents.
13. Use ◀ or ▶ to set the Number of Steps that you want the vent to take between being fully closed and fully open. Ideally use the maximum number of steps (for the most accurate control.) The important thing is that the ventilation effect of each step should be the same for each vent, so any vents that are smaller or have obstructed air flow should use fewer steps. (eg. vents are 2.0 m^2 and 1.2 m^2, so step size is 0.4 m^2, large vents have 5 steps and small vents have 3 steps.) Press **ENTER**.
14. Set the First Step Size. This is the time that it takes to go from fully closed to the end of the first step as a percentage of the time that it takes to go from fully closed to fully open. (eg. 4 steps means each step is 1/4 of the opening = 25%. If it takes 4 seconds to go from closed to 25% open, and it takes 10 seconds to go from closed to open, then First Step Size = 4/10 = 40%.) The first step is usually larger since it may take some time before the vent starts to open. Use ◀ or ▶ to set the Number of Steps to be used for the particular vent. Press **ENTER**.
15. Use ◀ or ▶ to set the Total Travel Time for the particular vent. This is the time that it takes to go from fully closed to fully open. Press **ENTER**.
16. Finally you can specify which of the ten outputs (numbered 0 - 9) are used to Open and Close each vent. We strongly recommend you use the default settings to avoid confusion: outputs 0,2,4,6,8 are Open for vents 1-5 respectively, and outputs 1,3,5,7,9 are Close for vents 1-5. Use ◀ or ▶ to set the Open Output for the vent. Press **ENTER**. Then use ◀ or ▶ to set the Close Output for the vent. Press **ENTER**.

The PicoCLIMATE Menu - monitor and set-up PicoCLIMATE

The PicoCLIMATE menu is accessed from the Alarm menu.



Hold **ENTER** for three seconds to access the hidden PicoCLIMATE menu.

PicoCLIMATE On/Off:

Shows if PicoCLIMATE is on or off. Press ◀ or ▶ to turn PicoCLIMATE On/Off. Press **ENTER** to move to the next screen.

Output Device:

Press ◀ or ▶ to select the PicoCLIMATE Output Device (must use Sequence). Press **ENTER** to move to the next screen.

PicoCLIMATE status:

Shows current setting of vents 1-5. Closed=0 Press ◀ or ▶ to manually override vents (see page 40). Press **ENTER** for next screen.

Maximum Air temperature:

Press ◀ or ▶ to set the maximum acceptable temperature in the greenhouse (10 to 39.9°).

Temperature hysteresis:

Use ◀ or ▶ to set the temperature hysteresis. Temperature must improve by this amount before alarm will cancel. (Minimum temp. = Maximum - hysteresis)

Wait time:

Use ◀ or ▶ to set the wait time (in seconds). PicoCLIMATE waits for the previous change to have an effect before making the next one.

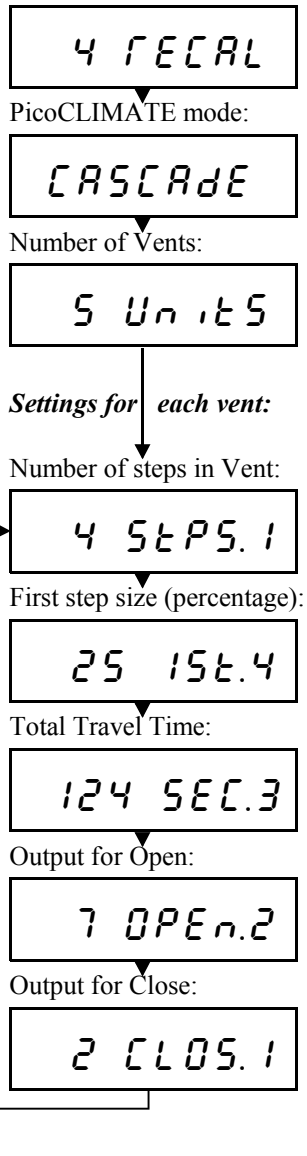
Alarm High Margin:

Use ◀ or ▶ to set the high margin. If the temperature exceeds Maximum by this amount then it will trigger an alarm.

Alarm Low Margin:

Use ◀ or ▶ to set the low margin. If the temperature drops below the Minimum by this amount then it will trigger an alarm. Press **ENTER** to move to the next screen.

Recalibration Rate:



Use ◀ or ▶ to set the number of times to automatically recalibrate the vents each day. Press **ENTER** to move to the next screen.

PicoCLIMATE mode:

Use ◀ or ▶ to choose from GROUP mode (all vents change together) or CASCADE mode (only change one vent at a time).

Number of Vents:

Use ◀ or ▶ to set the number of vents that are to be controlled by PicoCLIMATE. Press **ENTER** to make settings for each vent.

Settings for each vent:

Number of steps in Vent:

Use ◀ or ▶ to set the number of steps that you want for this vent (Note: ".1" indicates that this example is for vent 1).

First step size (percentage):

Use ◀ or ▶ to set the size of the first step for this vent as a percentage. (Note: ".4" indicates that this example is for vent 4).

Total Travel Time:

Use ◀ or ▶ to set the time (seconds) it takes the vent to go from Closed to Open. (Note: ".3" indicates that this example is for vent 3).

Output for Open:

Use ◀ or ▶ to select which of the ten outputs to activate to Open the vent. (Note: ".2" indicates that this example is for vent 2).

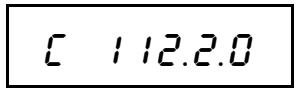
Output for Close:

Use ◀ or ▶ to select which of the ten outputs to activate to Close the vent. (Note: ".1" indicates that this example is for vent 1). Press **ENTER** to set up the next vent.

PicoCLIMATE Status Display - monitoring and overriding vents

The PicoCLIMATE Status Display shows the current state of each of the vents and allows the user to manually override any or all vents. To access the PicoCLIMATE status display, go to the **Alarm** menu, hold **ENTER** for three seconds, use ◀ or ▶ to turn PicoCLIMATE On if you need to, then press **ENTER** twice.

PicoCLIMATE Status Display:

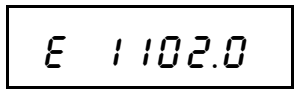


In this example we have 5 vents:
vents 1 and 2 are in position 1,
vents 3 and 4 are locked in position 2,
vent 5 is closed (position 0).

Manual Override

For complete control, the user may manually lock or change any vents in the system. This may be useful if some areas in the greenhouse are unused or damaged, or they need to be at a different temperature, or if some vents are exposed to excessive or unwanted wind or rain or noise.

While viewing the PicoCLIMATE Status Display, press ◀ or ▶ until the digit for the relevant vent is flashing. Press **ENTER** if you want to manually override the relevant vent. The display will change to the Edit Display.
PicoCLIMATE Edit Display:



Here, vents 1 and 2 are in position 1,
vents 3 and 5 are closed (position 0),
vent 4 has been manually set to pos. 2

In the Edit Display, use ◀ or ▶ to select the desired state for the flashing vent and then press **ENTER** to make it take effect. The vent will be locked in position (as shown by the trailing decimal point) until manually unlocked

Available manual override settings are:

0	Fully Closed
1,2,3,4,5	Slightly Open to Fully Open
r	Recalibrate (stays closed until unlocked)
u	Unlock it (return vent to normal operation)
-	Exit Edit mode without making any change.

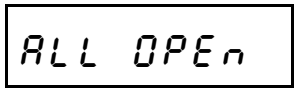
Emergency Override

The user may quickly force all vents open or closed (and lock them in that position) in emergency situations (eg. extreme winds, alarm conditions, etc)

While viewing the PicoCLIMATE Status Display:

- Hold ▶ and press **ENTER** to go to Emergency All Open mode. **OR**
- Hold ◀ and press **EXIT** to go to Emergency All Closed mode.

Emergency Override:



The words "OPEn" or "CLOS" flash while the vents are still in the process of changing to the emergency setting. After all vents have been set, the word "ALL" also flashes.

To cancel an emergency simply repeat the keypress that started it (eg. ◀ and **EXIT** to exit the All Closed emergency). You can switch from one emergency to another without cancelling the first one.

Emergencies effect any vents that were manually overridden prior to the emergency, but they will return to their previous manually overridden value after the emergency is cancelled. If this is a problem, then you should manually override each vent instead of using the emergency mechanism.

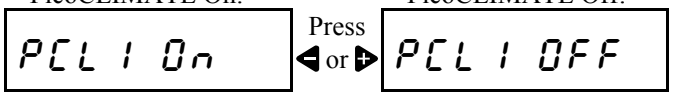
Emergencies are automatically cancelled at midnight every night. If this is undesirable then cancel the emergency and instead manually override (lock) each vent to the desired position, but also turn off any automatic recalibration process (which also occurs at midnight) by setting the RECAL to 0. Remember to restore RECAL and unlock vents after the emergency.

Installation of PicoCLIMATE

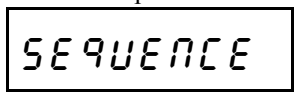
First you must put **MIST GUARD** into PicoCLIMATE mode and then set it to use the ten output sequence device:

Go to the **Alarm** menu and hold the **ENTER** button down for 3 seconds or more. **MIST GUARD** will enter the hidden PicoCLIMATE menu and display the current PicoCLIMATE mode and allow you to change it:

PicoCLIMATE On: PicoCLIMATE Off:



After turning PicoCLIMATE On, press **ENTER**:
Current Output Device:



Use the ◀ or ▶ buttons to select the ten output sequence board.
Press **ENTER** or **EXIT** when done.

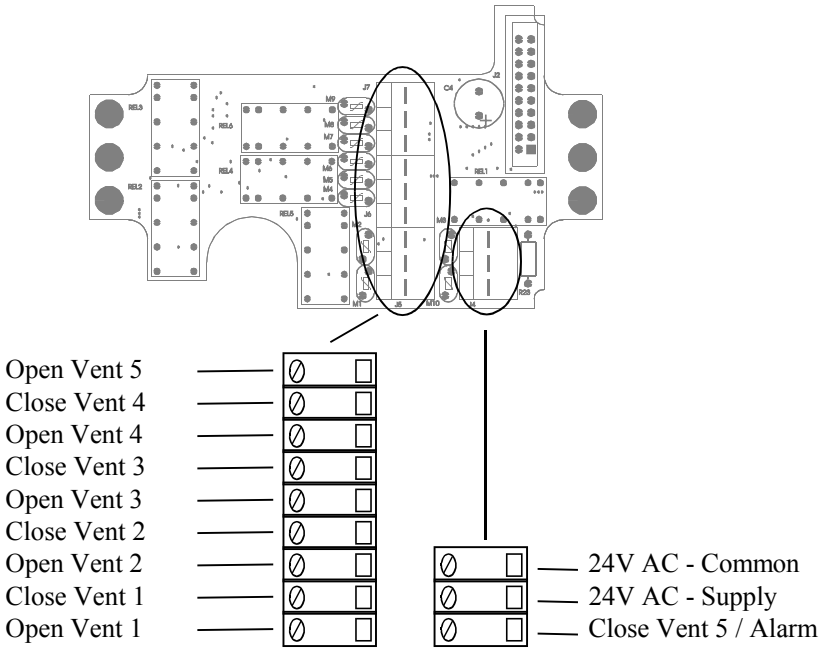
The ten output sequence expansion board requires an externally fused 24V AC supply to operate, and switches 24V AC to each output terminal in turn. When powered externally **MIST GUARD** draws no current from its batteries. If power fails **MIST GUARD** will continue to operate from battery power, but the expansion board will cease to function until power returns.

We recommend that each vent be connected to its default OPEN and CLOSE contacts (as in the following diagram), but they can be changed from their defaults, if required, using the Output for Open and Output for Close settings for each vent (see page 38).

Installing the ten output sequence expansion board

1. Remove the panel cover strips from the **MIST GUARD** unit. Unscrew and remove the cover. Remove the batteries.
2. Use the four screws provided to attach the expansion board to the mounting posts inside the back cover.
3. Unscrew and remove the blanking plug from the side of the **MIST GUARD** unit. (Retain this plug.) Firmly attach the large cable entry gland provided in place of the blanking plug.
4. Slide the gland cap over the end of the multi-core cable and insert the cable through the gland.

5. Strip 100mm of the outer sheath from the cable. Strip 10mm of insulation from each conductor.
6. Attach each conductor to its screw terminal on the expansion board, as shown on the following diagram.
7. Firmly attach the ribbon cable from the expansion board to the shrouded header on the **MIST GUARD** board.
8. Insert the two plastic hinges inside the corners of the case and cover.
9. Fasten the hinges with the four countersunk screws. Don't over-tighten.
10. Apply power via the multi-core cable to the leads marked 24VAC and Common on the following diagram.
11. Ensure **MIST GUARD**'s display is operating normally. Replace the batteries.
12. Close the unit, taking care that no cables are caught in the case seal.
13. Tighten the case screws and replace the cover strips on the panel.
14. Tighten the cable entry gland cap.



Use 12-core unshielded cable to connect to an external junction box.
Connect one lead of each output device to 24V AC Common.
Each output is rated at 1A max. Total output current is 2A max.
"Close vent 5" output can be used as an Alarm output: see page 35.

PicoCLIMATE

Testing the PicoCLIMATE installation

1. If you are also using **MIST GUARD** for FrostGARD or HeatGARD operation, test the relevant installation first. Page 21 / 29
2. Check that all wiring (vents, alarm output) is complete. Page 42
3. Make sure each vent is correctly labelled (1 - 5).
4. Turn the external 24V AC power supply on.
5. Check that PicoCLIMATE is turned On. Page 42
6. Check that its Output Device is set to Sequence. Page 42
7. Check that all PicoCLIMATE settings have been made. Page 38
8. Manually override vent 1 (page 40) to set it to fully open. Verify that vent 1 does fully open without overrunning. Page 40
9. Verify the Total Travel Time and First Step Size settings. Page 38
10. Manually override vent 1 again to set it to fully closed. Verify that vent 1 does fully close. Page 40
11. Fix any incorrect wiring (eg. OPEN and CLOSE swapped, or wires going to wrong vent).
12. Repeat steps 7 - 10 for each vent.
13. Remove (unlock) the manual overrides from all vents. Page 40
14. If you have fewer than 5 vents and are using the PicoCLIMATE Alarm output (page 42), temporarily change the Maximum Air Temperature (page 38) to start the alarm. Verify that the output works satisfactorily.
15. Restore the Maximum Air Temperature to its proper setting and wait for the system to return to normal.
16. Clear the Log of any entries that have occurred. Page 8
17. Record your system settings, crop and hardware details. Page 47

NOTES

- Whenever PicoCLIMATE is restarted (eg. change of setting, power on), it first recalibrates all vents (to establish a known starting point). It leaves the vents closed until it detects the need for more ventilation.
- To verify the Total Travel Time the vent must start in the fully closed ("STOP") position. Start the motor and measure how long it takes for the vent to become fully open, (Ttotal). Do not include any extra time (eg. for overrun or for the vent to hit the other STOP) as this will make the other vent settings (eg. position 1, position 2) inaccurate.
- To verify the First Step Size the vent must again start in the fully closed ("STOP") position. Start the motor and measure how long it takes for the vent to start opening, (Tstart). Then calculate:

  First Step Size = 100% x (Tstart + (Ttotal - Tstart) / steps) / Ttotal

Routine Maintenance, Care and Cleaning

When properly installed **MIST GUARD** can relieve much of the tedium of manually operating crop protection systems. However, the responsibility for the well-being of the crop ultimately rests with the grower. Perform regular tests to ensure that the entire system is operating properly.

- Check the battery level, event log, alarm settings, temperature and humidity displays.
- Check **MIST GUARD**'s display and log for error messages and extreme values.
- Make a note of any irregularities and discuss with your dealer if you have questions not answered in this manual.
- Test the operation of the solenoid output.
- Check the sensor module regularly for mud or other obstructions to air flow, and if necessary flush gently with clean, low pressure water. The humidity sensor will recover from saturation once dry, after about 24 hours. Harsh cleaning methods, substances or poking may permanently damage sensors. Do not poke objects inside the module. Keep the case sealed while cleaning and whenever the unit is unattended.
- When the lid must be removed to install batteries or to connect cables, be particularly careful not to introduce water, dirt or other contaminates inside the case. Take care with screw-drivers and cable ends when accessing screw terminals. The circuitry is not designed to be handled or cleaned, and must not come into contact with metallic objects.
- The cable entry gland(s) should always be kept sealed, either by a cable or the rubber plug that ships with the unit. When a cable is inserted, keep the rubber plug inside the case to avoid losing it.

Event Log Table

Start date	Start time	Duration	Temperature	Humidity

Notes

	Frost Alarm	Heat Alarm	Dual Alarm
Crop description:			
Crop location:			
Solenoid / relay:			
Sprinkler / heater:			
Alarm Air temp:	°Air	°Air	°Air
Humidity setting:	°Chill	°Dry	%
On time:	h m	sec	sec
Off time:	h m	sec	sec
Hysteresis:	°	°	° %

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Specifications are subject to change without notice. 2006-05-15