**Troubleshooting & Specs**

- **CHHC-1**

  - **Amps / Volts requirements**: 15 amps @ 120 volts
  - **Remote sensor cable length**: 16 ft (can be up to 100')
  - **Min / Max operating temperature**: 32 to 120° F
  - **Min / Max operating Humidity**: 0-99% RH
  - **Temperature Measurement range**: 32 to 122° F
  - **Temperature Accuracy**: +/- 1.8° F
  - **Humidity Measurement range**: 10 to 95% rH
  - **Humidity Accuracy**: +/- 3% rH
  - **Light Sensor sensitivity**: Adjustable
  - **CO2 Measurement range**: 0-2500 PPM
  - **CO2 Accuracy**: +/- 75 PPM
  - **CO2 sensor warm-up time**: Less than 10 minutes
  - **Computer Interface**: Optional RS 232 / 9-pin D-sub
  - **Weight / Dimensions**: 5lbs / 8” x 6.5” x 3.1”
  - **Life Expectancy**: > 10 years

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**Instruction Manual**

**CHHC-1**

**Cooling - Heating - Humidity - CO₂ Controller**

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**Sentinel products are distributed by:**

GPS / Global Product Solutions LLC.

[www.growgps.com](http://www.growgps.com)

Printed in China
Sentinel has made controlling temperature, humidity and CO₂ PPM levels easy and affordable. The CHHC-1 combines an accurate digital temperature & humidity sensor with a state of the art NDIR CO₂ sensor in one reliable and easy to use controller. By controlling supplemental CO₂ with PPM (part-per-million) accuracy, plant growth can be accelerated by as much as 30%.

The CHHC-1 has been designed to maintain a specific CO₂ level. The user can select “Fuzzy-logic” mode when using compressed CO₂ or switch the mode to On / Off when using a gas-fired CO₂ generator.

Increasing the CO₂ from normal atmospheric level of 375 PPM to between 1250 PPM by using either compressed CO₂ or operating a combustible gas CO₂ generator has never been easier. The CHHC-1 measures the carbon dioxide level and automatically turns ON and OFF the CO₂ device to accurately keep the CO₂ level at the desired level.

The combination remote sensor assembly is also a great feature that allows the user to place the sensor up to 16 ft from the controller. The combo-probe contains a highly accurate temperature, humidity, light and CO₂ sensor. The sensors are enclosed in a shielded body and use high-quality shielded wiring to resist electronic noise from electronic ballasts or other EMI / EFI noise sources.

Troubleshooting & Specs

Problem: The unit does not power up at all.
Check and reset the circuit breaker on the bottom of the unit. If the problem continues, reduce the number of devices connected to the unit or use a PXM to control larger amperage devices.

Problem: The CO₂ outlet does not turn on.
1) There are different modes that can be selected. Refer to Understanding Interlocks to fully see how the modes affect the CO₂ function.
2) The Photocell inside the combination probe may affect the CO₂ function. Ensure the photocell is receiving enough light to activate it. (Green “Daytime” LED will be ON) The sensitivity of the photocell can also be adjusted if required.

Problem: The CO₂ reading does not seem to be accurate.
A quick check of the calibration of the CO₂ sensor can be performed. Refer to Calibrating CO₂ to recalibrate the sensor.

Problem: The unit has scrolling 8s for more than 10 minutes.
Turn the power switch Off for 5 seconds, then turn the switch On. After 10 minutes, the unit should complete the start-up and begin to display conditions of the area. If it does not, contact the factory.

Problem: The device I have connected to the Temperature or Humidity receptacle, cycles On & Off too much.
The dead-bands can be increased to reduce cycling of the device. Refer to the Operating the CHHC-1 section.

Problem: I would like to return the unit to its default settings.
The unit can be returned to it’s original factory setpoints. Pressing and holding the Enter / Reset and Down pushbuttons for 2 seconds will change the display to read f.Set. Pressing Enter / Reset again will return the unit to it’s factory default settings.

Problem: The digital display is frozen or changing rapidly.
Certain devices such as Electronic (Digital) Ballasts and Ozone generators produce a huge amount of electronic “noise”. If you are operating these other devices, locate them as far away from the controller as possible.
Connection examples

For indoor growing, Cooling devices such as ventilation fans or air-conditioners connect to the Cooling Device receptacle.

Connect your 120 volt compressed CO2 solenoid / regulator assembly to the CO2 receptacle.

OR

Dehumidifier or a humidifier can be connected to the Humidity Device receptacle.

OR

Heaters for cooler climate greenhouses can be connected to the Heat Device receptacle.

Hand sized remote combination probe senses temperature, humidity, CO2 PPM and light levels all in one small enclosure.

A quick look at the CHHC-1...

(8) LEDs allow user to quickly see Min / Max recorded values

LED displays temperature, humidity & CO2 levels

CO2 device connects here

Humidity device connects here

Heating device connects here

Cooling device connects here

15 button keypad to change settings

RS232 computer connection *(Optional)

Attractive high-impact injection molded enclosure

Re-settable circuit breaker

Heavy-duty Power cables, shielded probe cable

Combination remote probe, Temp, Humid, CO2 & light
Installing the CHHC-1

1) Locate a suitable location for the controller.
2) First secure the provided bracket to the wall. Next snap the controller into place and tighten the (2) thumb-screws top & bottom.
3) Place the remote probe assembly where it can accurately sense the environmental conditions. The sensor is NOT water proof. Do not locate the sensor where it may get sprayed with water.
4) Hang the remote sensor probe at plant height for best accuracy. The combination sensor is fragile and should be handled with care.
5) The controller requires a 120 volt, 15-amp power supply. Plug the power cable into a standard Nema 5-15 wall outlet.
6) The devices that will be controlled must be 120 volt & 15-amps or less. If larger electrical loads need to be controlled, use 1 or more PXMs to expand the power handling capability of the CHHC-1.
7) If you are using a cooling and heating device, connect the device’s power cable into the receptacles marked Cooling and Heat.
8) If you are using a separate humidifier or dehumidifier, connect it to the receptacle labeled Humidity Device.
9) Connect the CO2 device to the receptacle marked CO2 Device. You can operate a CO2 generator or a compressed CO2 regulator.
10) The light sensor inside the remote probe needs to be exposed to light. The sensitivity of the photocell is adjustable. (See Photocell sensitivity)
11) Turn the power switch to the ON position and the unit will begin to “warm-up”. While warming up, the display will show a series of the number 8 moving across the display. Warm-up takes about 4 minutes.

**NOTE:** In order for the CHHC-1 to work correctly for YOUR application, you may need to first check and change some factory setpoints. Refer to Operating the CHHC-1 section of this manual.

**NOTE:** If you are trying to connect large power hungry devices like air conditioners or dehumidifiers, you may have to use some Power Expansion Modules to provide the ability to switch higher amperage devices.

Photocell sensitivity

If necessary, the sensitivity of the photocell can be adjusted. The factory setting normally activates “daytime” with very low light levels required. If you need to change the sensitivity of the photocell, follow the procedure below.

Pressing and hold the **Enter / Reset** and **UP** button for 2 seconds will bring up the current photocell setpoint. To increase the sensitivity (turn ON Daytime mode with less light), increase the number setting. To decrease the sensitivity (require more light to activate Daytime mode), lower the number setting.

Changing display from F to C

The CHHC-1 can display the temperature in either in F or C. To change the temperature display, press and hold the **Up** and **Down** pushbuttons for 3 seconds.

Using with electronic (digital) ballasts

**Warning!!!**

Some electronic devices such as Electronic (Digital) HID ballasts and Ozone generators produce large amounts of electronic noise, which can affect other equipment. The Sentinel line of controllers and timers have been “hardened” by using shielded cable and shielded enclosures however... some EBs do not have proper shielding. For best results it is highly recommended to position your controller at least 8 ft away from any EBs (Electronic Ballasts). It is also a good idea to route the cables going from the EB to the HID lamp away from the controller and the remote temperature probe cable attached.

Keep Electronic ballast at least **8 ft away** from other electronic equipment.
CO2 control modes

There are 2 CO2 “modes” of operation. One mode is used when controlling CO2 generators, the other mode is used with compressed CO2 that comes in high pressure tanks. Selecting the appropriate mode before using the CHHC-1 is important for proper operation. The CO2 outlet is only activated during the “daytime”.

CO2 Generators:
The default mode of operation is gEnErAt for CO2 generators. In generator mode, the unit CO2 will be turned ON whenever the CO2 level is below the desired setpoint. The CO2 Deadband is also used in this mode. The deadband prevents the CO2 from turning ON / OFF too quickly and is factory set at 50PPM. If the setpoint is 1250 PPM, the CO2 outlet will be turned ON until it reaches 1300 PPM (1250 setpoint + 50 deadband = 1300 PPM) Once it reaches 1300, the CO2 is turned OFF. Once the CO2 level drops back to the setpoint of 1250 PPM, the CO2 is turned ON again and the process repeats until the unit senses it is night time.

Compressed CO2 tanks:
The optional mode of CO2 operation is Fuzzy Logic mode LogIcoN. It is used ONLY when using compressed CO2. This is because the logicon mode will be turning the CO2 device connected to the CHHC-1 ON and OFF at short intervals to attempt to keep the CO2 level inside the growing area as close as possible to the setpoint. When the CO2 level is close to the setpoint, the CO2 outlet will be turning ON and OFF every few seconds, this is normal. When the CO2 level is either well below or well above the setpoint, the output will remain steadier either ON or OFF.

NOTE: The rapid cycling of the CO2 outlet would cause problems if a CO2 generator was connected to the CHHC-1 in LogIcoN mode. Only use gEnErAt mode when using CO2 generators.

Pressing and holding the Enter / Reset button for 5 seconds will allow you to select generator mode gEnErAt for CO2 generators or Fuzzy Logic mode LogIcoN when using compressed CO2. Use the Up or Down buttons to change the display to the desired mode. Press Enter to accept the change.

There are 15 buttons on the CHHC-1. Below is a brief description, the next sections explain all of the functions in detail.

- Set CO2 PPM: Press this button to display and change the current CO2 Part-Per-Million setting. Factory setpoint 1250 PPM.
- Interlock CO2—Temp: Press this button to select whether the temperature and CO2 functions will be interlocked. Factory setpoint Split.
- CO2 Dead-band: Press this button to display and change the current CO2 Dead-band. Factory setpoint 50 PPM.
- CO2 Calibrate: Press this button to re-calibrate the CO2 sensor. * Refer to the Calibration section. Factory setpoint 380 PPM.
- Set Day Temp: Press this button to set the Day Cooling and Heating setpoint. Factory setpoint Cooling 80°F / Heating 55°F.
- Set Night Temp: Press this button to set the Night Cooling and Heating setpoint. Factory setpoint Cooling 70°F / Heating 55°F.
- Temp Dead-band: Press this button to set the Cooling & Heating temperature Dead-band setting. Factory setpoint 3°F heat & cool.
- Set Humid: Press this button to set the Day and Night humidity setpoints. Factory setpoint 50 % rH.
- Interlock Humid—Temp: Press this button to select whether the humidity & temperature functions will be interlocked. Factory setpoint Split.
- Humid Dead-band: Press this button to set the Humidity Dead-band setting. Factory setpoint 3%.
- Humid Mode: Press this button to select either humidification (rH Incr) or dehumidification (rH decr) modes. Factory setpoint rH decr
- Min / Max Recall: Pressing this button repeatedly will recall the stored measurements for Temp / Humid & CO2. Pressing and holding the Enter / Reset button while the recorded value is displayed will reset the Min / Max values.
- UP: Press this button to display to increase the setting.
- Down: Press this button to display to increase the setting.
- Enter/Reset: Press this button accept and enter the new setpoint and also to reset the Min / Max recorder values. (* Pressing and holding the Enter / Reset button also activates & deactivates the Fuzzy-Logic CO2 mode.)
Understanding Interlocks

Understanding how the unit works is important if you are going to get the most out of the unit.

Interlocks are used to select if certain functions will be interlocked “linked” together or operate independently. For example, if you want the CO2 device to be disabled while the ventilation - fan is operating, you can select the CO2 / Temp interlock to be activated by setting the interlock to connect mode. See below for details.

Interlock CO2 / Temp
* Using ventilation fans for cooling.
If you are using ventilation fans to keep the growing area cool, warm and humid air inside the growing area is being replaced by dry and cooler outside air from outside the area. It is advisable to NOT operate the CO2 device when a ventilation fan is in the process of exchanging air. So is this example you would want to select to connect the Interlock CO2 & Temp so that the CO2 is turned OFF when the cooling fan is activated. This will reduce the amount of CO2 being used and reduce waste.

NOTE: There are exceptions to this rule. If you are operating compressed CO2, it is important to disable the CO2 while the ventilation fan is operating, because of the high-cost of CO2. However if you are operating an economical CO2 generator, you may choose to allow both the ventilation fan and the CO2 generator to run at the same time. (see below)

Using air conditioning for cooling.
If you are using a recycling air conditioner to keep the growing area cool, the air inside the growing area is NOT being exchanged with outside air. There is no problem operating the CO2 device and the cooling device AT THE SAME TIME. So is this example you would want to select to split the Interlock CO2 & Temp so that the CO2 is controlled independently of the cooling device. If the area gets too warm, the cooling device will operate, if the CO2 is too low, the CO2 device will operate completely independent of each other.

NOTE: If you are using a CO2 generator, you may want to choose to disable the CO2 generator while the air conditioner is operating to reduce the amount of heat it needs to remove. (see above)

Calibrating the CHHC-1

CO2 Calibrate Even though the CHHC-1 has been designed for many years of trouble-free operation, occasional the need arises to re-calibrate the CO2 sensor. Calibrating the unit will restore the sensor’s ability to accurately measure the CO2 levels.

NOTE: Recalibration of the CO2 sensor must be completed away from all animals and people OUTDOORS! Follow the procedure exactly.

The CO2 sensor has a lifetime of over 10 years. However, over the life of the sensor, dust and other contaminants can accumulate on the inner optical surfaces of the sensor cell itself. To adjust for the contamination, the calibration feature is provided. If the unit appears to not be measuring the CO2 levels correctly or if the unit has been dropped or jarred severely, you should recalibrate the unit.

NOTE: Annual calibration is HIGHLY recommended.

1) Locate an area outdoors away from people, animals and high traffic areas. The unit must be shaded and NOT placed in direct sunlight.
2) Plug in the unit in and allow the unit to warm up for approximately 30 minutes. Note: Waiting longer (1+ hours) provides more accurate calibration.
3) Try not to exhale or breath on the unit while activating the calibration function. Once activated, leave the unit alone for at least 10 minutes.
4) To activate the automatic calibration sequence, press the CO2 Calibrate button. will display the “new” ambient CO2 level _380_PP. If the unit will be calibrated in an area of high vehicular traffic, or near people, a slightly higher calibration point should be selected.
5) The calibration level can be changed by using the UP and Down buttons. If you live in a highly populated city, you may increase the calibration level to 400-475 PPM.
6) Pressing Enter / Reset will start the calibration process. The display will read Co2_CAL and a small green LED will be flashing. LEAVE THE UNIT ALONE! The process takes about 2-6 minutes. When complete, the display returns to normal operation.
7) The CO2 sensor calibration can be repeated as often as necessary.
display reads HEAt _ F use the Up or Down buttons to change the settings and then press Enter to accept the new setting.

Setting the CO2 PPM level:
**Set CO2 PPM** To change the CO2 PPM setting, press the **Set CO2 PPM** button on the keypad. Use the **Up** or **Down** button to change the setting, example 1500_PP. Press **Enter** to accept the new setpoint.

Setting the CO2 / Temp Interlock:
**Interlock CO2 / Temp** You may choose to have the CO2 output disabled when the Cooling output is ON, CoNNeCt, or to let them work independently, SPLit. (See Understanding Interlocks) Pressing the **Interlock CO2—Temp** button, will display the current setting. Use the **Up** or **Down** buttons to change the display to the desired mode. Press **Enter** to accept the change.

Setting the CO2 Dead-band:
**Set CO2 Deadband** The CO2 Dead-band can be set by the user. The dead-band is the range of measurement that the control will allow the CO2 level to vary by. Press the **CO2 Deadband** button on the keypad to display the current setting. It is suggested to leave the setting at 0050_PP. If necessary use the **Up** or **Down** buttons to change the display to the desired setting. Press **Enter** to accept the change.

Recalling minimum and maximum recorded values:
**Min / Max Recall** The user can recall the minimum and maximum recorded values for the Temperature, Humidity and CO2 levels easily. Press the **Min / Max Recall** button on the keypad. Each time the button is pressed, the display will advance to show in order: Max Temp / Min Temp / Max Humid / Min Humid / Max CO2 / Min CO2. Each recorded value is identified with a small green LED on the front of the unit. When desired the values can be reset by pressing and holding the **Enter / Reset** button for 2-3 seconds.

Activating Fuzzy-logic CO2 mode:
**Fuzzy-logic mode** There is no independent button used to activate the Fuzzy Logic mode. Pressing and holding the **Enter / Reset** button for 5 seconds will allow you to select generator mode gEnErAt for CO2 generators or Fuzzy Logic mode LogIcoN when using compressed CO2. Use the **Up** or **Down** buttons to change the display to the desired mode. Press **Enter** to accept the change. (See CO2 control modes section)

The second Interlock is for Humidity and Temperature. They can be selected to be either connected together into a single control, or split into separate controls. The Humid / Temp interlock allows the user to decide.

**Interlock Humid / Temp**
* Using ventilation fans for cooling and dehumidification. If you are using ventilation fans to keep the growing area cool and also to remove humidity, you need to be able to activate the ventilation fan when the temperature rises OR the humidity has increased to the set-points. By setting the Interlock Humid / Temp to connect, the Cooling device will be turned ON when the temperature or humidity sensor detects a rise in EITHER of them. The warm and humid air inside the growing area would being replaced by dry and cooler outside air from outside the area. If you are NOT using a single ventilation fan to both cool and the dehumidify, you would select the Interlock Humid / Temp mode to split. (see below)

Using separate devices for cooling and dehumidification.
If you are using a fan or air conditioner to keep the growing area cool and a dehumidifier to remove humidity, the Cooling and Humidity functions need to be independent. In this situation the cooling device will be activated when the temperature rises. The humidity device will be activated if the humidity level gets too high. By setting the Interlock Humid / Temp to split, each device is controlled independently. The Cooling device will be turned ON when the temperature gets too warm and the humidity device will be turned ON when humidity gets too high. If you using a single ventilation fan or air conditioner to both cool and to dehumidify, you would select the Interlock Humid / Temp mode to connect. (see above)

Using separate devices for cooling and humidification.
If you are using a fan or air conditioner to keep the growing area cool and a humidifier to increase humidity, the Cooling and Humidity functions need to be independent. In this situation the cooling device will be activated when the temperature rises. The humidity device will be activated if the humidity level gets too low. By setting the Interlock Humid / Temp to split, each device is controlled independently. The Cooling device will be turned ON when the temperature gets too warm and the humidity device will be turned ON when humidity gets too high. It is unusual to have to increase humidity in a closed growing area so this example is rarely used. (see other examples above)
Operating the CHHC-1

The CHHC-1 has 15 pushbuttons that are used to select the settings. In some cases, the pushbutton accesses more than one setting, other buttons access a single setting. Pressing a button more than once will display all of the available settings. If there is only a single setting available, the display will return to normal operation when pressed a 2nd time. This section explains each of the pushbutton functions in detail.

Setting the Humidity level:

**Set Humid** There are 2 setpoints for the humidity level, one for daytime and one for nighttime. To change the settings, press the **Set Humid** button on the keypad. The display reads `daY__rH` which is the current Daytime humidity setting. To change the setting, use the **Up** or **Down** buttons and then press **Enter** to accept the new setpoint. Pressing the **Set Humid** button a 2nd time displays the current night-time humidity setting, `nit__rH`. It is changed the same way as the Day humidity setting.

**NOTE:** The difference between the Day cooling and heating settings must be more than the combined Deadband settings or else BOTH Cooling and Heating devices could be turned on at the same time.

Setting the Humidity / Temp Interlock:

**Interlock Humid / Temp** Interlocks are used to select if certain functions will be interlocked “linked” together or operate independently. The Humidity / Temperature interlock can be set one of 2 ways. (See Understanding Interlocks) To change the setting, press the **Interlock Humid / Temp** button on the keypad. The display reads either **SPLit** or **COnnEct** which is the current setting. To change the setting, use the **Up** or **Down** buttons and then press **Enter** to accept the new setpoint.

**NOTE:** The difference between the Night cooling and heating settings must be more than the combined Deadband settings or else BOTH Cooling and Heating devices could be turned on at the same time.

Setting the Humidity Deadband:

**Humid Deadband** The humidity deadband should only be changed if the factory settings are not sufficient. (See note) To change the setting, press the **Humid Deadband** button on the keypad. The display reads `05.0_rH` which is the current deadband setting. To change the setting, use the **Up** or **Down** buttons and then press **Enter** to accept the new setpoint.

**Set Night Temp** There are 2 setpoints for the Night temperature, one for cooling and one for heating. To change the settings, press the **Set Night Temp** button on the keypad. The display reads `COOL_ _F` which is the current Nighttime cooling setting. To change the setting, use the **Up** or **Down** buttons and then press **Enter** to accept the new setpoint. Pressing the **Set Night Temp** button a 2nd time displays the current Night-time heating setting, `HEAt_ _F`. It is changed the same way as the Day cooling setting.

Setting the Humidity Mode:

**Humid Mode** The Humidity Mode can be set one of 2 ways, humidify (**rH Incr**) or dehumidify (**rH dEcr**). To change the setting, press the **Humid Mode** button on the keypad. The display reads `05.0_rH` which is the current deadband setting. To change the setting, use the **Up** or **Down** buttons and then press **Enter** to accept the new setpoint.

Setting the Humidity Deadband:

**Humid Deadband** You can select separate deadband settings for heating and cooling. To change the setting, press the **Temp Deadband** button on the keypad. The display reads `COOL_ _F` which is the current deadband setting. To change the setting, use the **Up** or **Down** buttons and then press **Enter** to accept the new setpoint.