



# CO<sub>2</sub>-4 Temperature, Humidity & CO<sub>2</sub> Control

Custom Automated Products offers a full range of equipment for the growing enthusiasts. The CO<sub>2</sub>-4 will control the temperature, humidity and CO<sub>2</sub> levels within your growing area. It has 4 sequence timers for coordinating the ventilation and the CO<sub>2</sub> enrichment. It can also be used with the PPM-1c digital CO<sub>2</sub> sensor for PPM accuracy.

## OVERVIEW

The CO<sub>2</sub>-4 controls (lowers) temperature by turning on an exhaust fan or AC unit. External remote temperature probe is very reliable and it can be placed up to 30" from the unit.

Humidity is controlled independently of temperature.

Three indicator lights verify Exhaust, CO<sub>2</sub> on and PPM level.

Photocell ensures CO<sub>2</sub> valve or generator is only active during the day when the HID lights are on.

Optional Part-Per-Million sensor (PPM-1c) can be combined with the CO<sub>2</sub>-4 for an extremely accurate method of controlling CO<sub>2</sub>.

Four timers are used to fully coordinate CO<sub>2</sub> and Exhaust functions.

The CO<sub>2</sub>-4 is a solid & reliable unit with a 3-year warranty!

## INSTALLATION

There are certain steps which should be taken to ensure a successful installation of your CO<sub>2</sub>-4.

1) Determine the desired location for the CO<sub>2</sub>-4. It should be at plant height and near a 120 volt power supply.

2) The external remote temperature probe can be uncoiled to place the probe up to 30" from the unit.

**\* NOTE: DO NOT BEND TIGHTLY OR KINK THE SILVER CAPILLARY TUBE.**

3) Mount the CO<sub>2</sub>-4 to a wall or other vertical surface. The photocell, which controls the day/night function of the CO<sub>2</sub>-4, must be facing a source of light. If the light level is too low, the CO<sub>2</sub> function may not be activated.

4) Keep the CO<sub>2</sub>-4 far from any CO<sub>2</sub> generator or other sources of high heat to eliminate faulty temperature readings.

5) A 3 wire outlet must be used. **Do not use 2 wire adapters or cords to operate the CO<sub>2</sub>-4. (Maximum 15 amps @ 120 volts)**

7) Read the rest of the manual!!! It has been designed to take you step by step to make start-up easier. You will have to make several decisions in order to utilize the CO<sub>2</sub>-4 to it's full potential.

8) Connect the power cord to a source of 120 volt power. \* Maximum COMBINED load = 15 amps.

9) Connect your CO<sub>2</sub> Regulator or Generator to the CO<sub>2</sub> Valve/Generator outlet on the left side of the CO<sub>2</sub>-4.

10) Connect your Exhaust Fan or Air Conditioner to the Exhaust outlet on the right side of the CO<sub>2</sub>-4

11) Set your desired temperature and humidity.

12) **Read the rest of the instructions to determine how to set the 4 timers!**

**\* NOTE: The CO<sub>2</sub>-4 requires "free air movement" to maintain temperature and humidity accuracy. The top and bottom of the enclosure has ventilation slots to provide air-flow for the internal humistat. We recommend using an oscillating fan or similar air movement device to provide fresh air for the plants, and the sensors.**

## PRECAUTIONS

**Do not expose the CO<sub>2</sub>-4 to water. Electrical shock may occur.**

**Do not disable the fuse or put in a fuse that is not rated for 15 amps at 120 volts.**

**Do not kink the capillary tubing! Your temperature will not read correctly.**

**Do not open the CO<sub>2</sub>-4. There are no user serviceable parts inside.**



# **CONTROLS & TIMERS**

## **MAKING CONNECTIONS**

The CO<sub>2</sub> and Exhaust functions controlled by the CO<sub>2</sub>-4 are accessed using two standard 120 volt receptacles mounted on the sides of the enclosure. Printed labels on the front face of the enclosure identify the receptacles. ***Do not exceed 15 amps combined load.***

We highly recommend using only 3 wire devices with a ground. Double-insulated devices are acceptable.

## **PPM OPTION QUICK DISCONNECT**

The CO<sub>2</sub>-4 comes standard with a very effective timed CO<sub>2</sub> control system. However, if you want to control CO<sub>2</sub> levels to actual Parts Per Million, it's as simple as plugging in our PPM-1c CO<sub>2</sub> monitor / controller. Connecting the PPM-1c to the connector on the side of the enclosure automatically switches the CO<sub>2</sub>-4 to control CO<sub>2</sub> levels by PPM.

***\*NOTE: If you are not using a PPM-1c, you must keep the jumper plug attached.***

## **TEMPERATURE CONTROLLER**

The CO<sub>2</sub>-4 utilizes a remote-bulb thermostat with a 30" lead to control ventilation and cooling functions. This allows you to place the temperature sensor up to 30" away from the CO<sub>2</sub>-4. The thermostat can be set to control temperature from 50 – 115° F.

The thermostat is coordinated with the CO<sub>2</sub> control system and the exhaust receptacles to maintain a constant temperature. When the temperature rises above the set point selected on the thermostat, the CO<sub>2</sub> system is disabled and the exhaust outlet is enabled. When the temperature level drops below the set point, the CO<sub>2</sub> system is reactivated.

## **HUMIDITY CONTROLLER**

The CO<sub>2</sub>-4 utilizes a dehumistat to control ventilation and humidity levels. The dehumistat can control humidity levels from 20% - 80%.

The dehumistat is coordinated with the CO<sub>2</sub> control system and the exhaust receptacles to maintain a constant humidity. When the humidity rises above the set point selected on the dehumistat, the CO<sub>2</sub> system is disabled and the exhaust outlet is enabled. When the humidity level drops below set point, the CO<sub>2</sub> system is reactivated.

## **ADJUSTABLE TIMERS**

The four adjustable timers on the CO<sub>2</sub>-4 are set using the dials on the front face of the enclosure. The timer name and range of each timer is printed around the timer dials. Because the dials of the CO<sub>2</sub>-4 are small to conserve space, the settings may have to be adjusted to an actual time setting. Use a watch or stopwatch to confirm the settings are correct. Once the timers are set, they are repeatable to +/- .5%.

For detailed information about how to set your timers, see the CO<sub>2</sub> Control section of this manual.

***\*NOTE: In order for the timers to accept a new setting, the timer must either complete it's preset cycle or, power must be cycled off, then on. Follow the procedures below to set the CO<sub>2</sub> timers correctly.***

## **CO<sub>2</sub> CONTROL**

### **CO<sub>2</sub> BASICS**

In order to maximize the benefits of CO<sub>2</sub> enrichment, you must first control the air temperature and humidity levels. Then and only then can you control the CO<sub>2</sub> level. The CO<sub>2</sub>-4 has the right tools for the job.

Carbon Dioxide is present in relatively low quantities (about 350 ppm) in your normal everyday air. But plant growth can be increased and accelerated if the level of CO<sub>2</sub> is increased to 1000-1500 ppm. For this reason, we designed the CO<sub>2</sub>-4.

The CO<sub>2</sub>-4 CO<sub>2</sub> control system was designed to be used for both compressed CO<sub>2</sub> cylinders, and CO<sub>2</sub> generators. The CO<sub>2</sub> receptacle is 120 volts. It can run any load up to 15 amps. Compressed CO<sub>2</sub> cylinders require an approved regulator / flow gauge and a valve.

If optimum CO<sub>2</sub> "mileage" is desired, a self contained air conditioner or other "Closed loop" cooling method is recommended. A closed loop system will regulate temperatures within the zone allowing you to extend the CO<sub>2</sub> maximum cycle time thus reducing CO<sub>2</sub> use dramatically.

Another method of reducing heat build up includes utilizing "Air-Cooled Lighting Reflectors". Just be sure to make the ventilation system of the hood as airtight as possible so that your CO<sub>2</sub> is not being drawn out of the area by the ventilated hood exhaust fan.

If sufficient CO<sub>2</sub> is used and the proper level of nutrients and light is available, a 35% increase in growth rate is possible. Each application is different, so there is some work involved in finding the optimum set-up.

# CO<sub>2</sub> CONTROL MODES

The CO<sub>2</sub>-4 provides both a standard timed CO<sub>2</sub> mode and an *optional* integrated CO<sub>2</sub> PPM control mode. The optional PPM-1c controller is the most precise and efficient method of distributing CO<sub>2</sub>.

**\*NOTE: If the PPM-1c is not being used, the jumper-plug supplied with the CO<sub>2</sub>-4 must be plugged into the Quick Disconnect on the lower left side of the enclosure in order for the CO<sub>2</sub>-4 to function correctly.**

## TIMED CO<sub>2</sub> CONTROL MODE

The CO<sub>2</sub>-4 uses 4 timers for exhaust and CO<sub>2</sub> control. The four timers are the **Overall Cycle Time**, **Exhaust Cycle Time**, **CO<sub>2</sub> Inject Duration**, and the **CO<sub>2</sub> Inject Frequency**.

The **Overall Cycle Time** is the longest amount of time that the CO<sub>2</sub>-4 will run without an exhaust cycle. This timer will automatically start an exhaust cycle and disable the CO<sub>2</sub> temporarily. This timer can be set from 5 minutes to 3 hours. This timer is helpful in applications, which do not experience a build-up of heat and humidity. Set this timer as high as possible to maximize CO<sub>2</sub> efficiency.

The **Exhaust Cycle Time** is the shortest amount of time that the ventilation system will run when it is activated. It can be set from 2 to 60 minutes. As discussed earlier, a thermostat and a dehumidistat are used to interrupt CO<sub>2</sub> use if the temperature or humidity rises above the preset level. When the temperature or humidity has dropped below the set points, the Exhaust duration timer begins to time out. This will lengthen the overall CO<sub>2</sub> cycle time and prevent "Short-cycling" the CO<sub>2</sub> system. This results in reducing CO<sub>2</sub> waste. Especially useful if the temperature within the growing area increases during the hottest part of the day.

The **CO<sub>2</sub> Inject Duration** can be set from 30 seconds to 20 minutes. When the CO<sub>2</sub>-4 is powered up, the CO<sub>2</sub> cycle begins if the photocell determines that it is daytime. The CO<sub>2</sub> outlet is energized for the time set using the CO<sub>2</sub> Inject Duration timer.

The **CO<sub>2</sub> Inject Frequency** works in conjunction with the CO<sub>2</sub> Inject Duration timer. This timer can be set from 3 to 120 minutes. During the CO<sub>2</sub> cycle, the CO<sub>2</sub> outlet will be turned off for the amount of time set on this timer. The CO<sub>2</sub> Inject Duration timer and the CO<sub>2</sub> Inject Frequency timer continue to recycle until the Overall Cycle Time times out or the temperature or humidity setting is exceeded. When the Overall Cycle Time times out, the CO<sub>2</sub> is disabled, the exhaust is enabled and the Exhaust Cycle Time begins.

## PPM CO<sub>2</sub> CONTROL MODE (OPTIONAL WITH PPM-1c CO<sub>2</sub> MONITOR)

The CO<sub>2</sub>-4 can control CO<sub>2</sub> levels within the growing area with parts per million (PPM) accuracy when used in conjunction with the PPM-1c controller. Simply removing the jumper plug and connect the PPM-1c into the quick disconnect on the bottom of the CO<sub>2</sub>-4. This gives you the ability to fully control CO<sub>2</sub> with PPM accuracy. Just set the PPM level on the PPM-1c that you wish to maintain, and the CO<sub>2</sub>-4 in conjunction with the PPM-1c will coordinate your CO<sub>2</sub> and ventilation.

The PPM-1c controller consists of an infrared detector capable of measuring CO<sub>2</sub> levels from 0 to 5000 PPM. When it is connected, it will enter a warm-up mode. The warm-up may take up to 10 minutes to complete depending on the ambient air temperature. During this time, the digital readout may be fluctuating, this is normal. When the digital readout stabilizes, a level between 250 to 650 should be displayed. Be careful however, simply breathing on the PPM-1c controller will greatly increase the CO<sub>2</sub> level in the air resulting in a higher reading.

With the PPM-1c connected, the **CO<sub>2</sub> Inject Frequency** doubles as a CO<sub>2</sub> sample timer when using the PPM-1c controller. Because it may take a couple of minutes from the time CO<sub>2</sub> is released for the PPM-1c to detect a higher CO<sub>2</sub> level, this timer will provide a delay for the PPM controller to sense this increase in the CO<sub>2</sub> level before releasing more CO<sub>2</sub>. If you find the CO<sub>2</sub> level is overshooting the CO<sub>2</sub> set point, try increasing the **CO<sub>2</sub> Inject Frequency** timer. This will give the PPM-1c more time to sense the rise in CO<sub>2</sub>.

**\*NOTE: Do not start a CO<sub>2</sub> cycle until the PPM-1 has completed the "warm-up" and the display has stabilized.**

**\*NOTE: Failure to follow these instructions may result in unexpected operation.**



PPM-1c

## TROUBLESHOOTING

If you are having problems with this unit, refer to these troubleshooting hints.

### *Problem*

### *Suggested Action*

***There are no lights and no function at all.***

Check fuse or main power. Check the main power plug and replace the fuse if required with a 15 amp rated fuse.

***The Fuse blows repeatedly.***

If the fuse blows repeatedly, verify that the devices connected to the unit are working properly and that they do not exceed a combined 15 amps. If your devices exceed 15 amps, you may need to use an expansion module (UPM, HPR or MLC)

Verify that the devices connected to the unit are working properly. Check for short circuits by plugging devices into a wall outlet and checking for proper operation.

***The exhaust fans rarely turn off.***

You may have too much heat building up in your area or too small of an exhaust fan. Reduce the heat sources or increase your fan size.

Air Cooled lighting may solve the problem. Heat from lighting is the number one problem with indoor growing.

***My CO<sub>2</sub> outlet never comes on.***

Verify the jumper in the CO<sub>2</sub> PPM Sensor is connected.

If you are using a PPM-1c, the "PPM level low" light will be on when the actual measured CO<sub>2</sub> level is below your desired set point. If the "PPM level low" light is not ON the CO<sub>2</sub> outlet will not energized.

If the Exhaust outlet is ON, the CO<sub>2</sub> will not be allowed to run. Turn up the Temperature and/or Humidity to a higher setting.

Check the function of the photocell by shining a flashlight on it. If the Exhaust is OFF and the PPM Level Low light is ON, the only other cause may be a faulty photocell.

***The fans are running so often, the CO<sub>2</sub> is hardly ever ON.***

You may have too much heat building up in your area or too small of an exhaust fan. Reduce the heat sources or increase your fan size.

You may also consider using a "closed-loop" air conditioner to keep the temperature and humidity below the set points so that CO<sub>2</sub> is allowed to run for longer amounts of time.

***My CO<sub>2</sub> consumption seems to be quite high.***

Make sure your area is sealed. You may want to install a motorized damper to seal your exhaust fans when they are OFF. Even though the CO<sub>2</sub>-4 operates a standard "timed-release" sequence, you may still be wasting CO<sub>2</sub>.

If you are operating compressed CO<sub>2</sub> valves, consider purchasing the optional PPM-1c "Part-Per-Million" sensor to upgrade to PPM control. The PPM-1c offers a significant improvement in CO<sub>2</sub> efficiency.

***The CO<sub>2</sub> level "overshoots" the PPM-1c set point considerably.***

When using the PPM-1c, the CO<sub>2</sub> timers still control the duration of the "ON" and "OFF" time of the CO<sub>2</sub> valve or generator. Small areas need less "Inject Duration" time than do larger areas. Larger areas need more "Inject Frequency" time in order to give the CO<sub>2</sub> time to "mix" properly with the ambient air and measured by the PPM sensor.

Start with lower CO<sub>2</sub> timer settings for small areas and increase the timer settings for larger ones.

## WARRANTY

***The CO<sub>2</sub>-4 is warranted against defects in workmanship and parts for Three Years.***

## SPECIFICATIONS

Main power voltage:	120 volts	Maximum amperage:	15 amps
Temperature control range:	50-115° F	Temperature operating range:	32-120° F
Humidity control range:	20 - 80% with a 5% differential	Humidity operating range:	0-99%
Relay operating life:	100,000 electrical		

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