



CO₂-4e Temperature, Humidity & CO₂ Control

Custom Automated Products offers a full range of equipment for the growing enthusiasts. The CO₂-4e will control the temperature, humidity and CO₂ levels within your growing area. It has 4 sequence timers for coordinating the ventilation and the CO₂ enrichment. It can also be used with the PPM-1c digital CO₂ sensor for PPM accuracy.

OVERVIEW

- The CO₂-4e 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.
- Two indicator lights verify Exhaust or CO₂ on.
- Photocell ensures CO₂ 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 CO₂-4e for an extremely accurate method of controlling CO₂.
- Four timers are used to fully coordinate CO₂ and Exhaust functions.
- The CO₂-4e 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 CO₂-4e.

- 1) Determine the desired location for the CO₂-4e. 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 CO₂-4e to a wall or other vertical surface. The photocell, which controls the day/night function of the CO₂-4, must be facing a source of light. If the light level is too low, the CO₂ function may not be activated.
- 4) Keep the CO₂-4e far from any CO₂ 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 CO₂-4e. (Maximum 15 amps @ 120 volts)**
- 6) 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 CO₂-4e to it's full potential.
- 7) Connect the power cord to a source of 120 volt power. *Maximum COMBINED load = 15 amps.
- 8) Connect your CO₂ Regulator or Generator to the CO₂ Valve/Generator outlet on the left side of the CO₂-4e.
- 9) Connect your Exhaust Fan or Air Conditioner to the Exhaust outlet on the right side of the CO₂-4e
- 10) Set your desired temperature and humidity.
- 11) **Read the rest of the instructions to determine how to set the 4 timers!**

*** NOTE: The CO₂-4e 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 CO₂-4e 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 CO₂-4e. There are no user serviceable parts inside.**



CONTROLS & TIMERS

MAKING CONNECTIONS

The CO₂ and Exhaust functions controlled by the CO₂-4e 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 CO₂-4e comes standard with a very effective timed CO₂ control system. However, if you want to control CO₂ levels to actual Parts Per Million, it's as simple as plugging in our PPM-1c CO₂ monitor / controller. Connecting the PPM-1c to the connector on the side of the enclosure automatically switches the CO₂-4e to control CO₂ levels by PPM.

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

TEMPERATURE CONTROLLER

The CO₂-4e 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 CO₂-4e. The thermostat can be set to control temperature from 50 – 115° F.

The thermostat is coordinated with the CO₂ control system and the exhaust receptacles to maintain a constant temperature. When the temperature rises above the set point selected on the thermostat, the CO₂ system is disabled and the exhaust outlet is enabled. When the temperature level drops below the set point, the CO₂ system is reactivated.

HUMIDITY CONTROLLER

The CO₂-4e utilizes a dehumistat to control ventilation and humidity levels. The dehumistat can control humidity levels from 20% - 80%.

The dehumistat is coordinated with the CO₂ control system and the exhaust receptacles to maintain a constant humidity. When the humidity rises above the set point selected on the dehumistat, the CO₂ system is disabled and the exhaust outlet is enabled. When the humidity level drops below set point, the CO₂ system is reactivated.

ADJUSTABLE TIMERS

The four adjustable timers on the CO₂-4e 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 CO₂-4e 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 CO₂ 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 CO₂ timers correctly.**

CO₂ CONTROL

CO₂ BASICS

In order to maximize the benefits of CO₂ enrichment, you must first control the air temperature and humidity levels. Then and only then can you control the CO₂ level. The CO₂-4e 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 CO₂ is increased to 1000-1500 ppm. For this reason, we designed the CO₂-4e.

The CO₂-4e CO₂ control system was designed to be used for both compressed CO₂ cylinders, and CO₂ generators. The CO₂ receptacle is 120 volts. It can run any load up to 15 amps. Compressed CO₂ cylinders require an approved regulator / flow gauge and a valve.

If optimum CO₂ "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 CO₂ maximum cycle time thus reducing CO₂ 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 CO₂ is not being drawn out of the area by the ventilated hood exhaust fan.

If sufficient CO₂ 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.

CO₂ CONTROL MODES

The CO₂-4e provides both a standard timed CO₂ mode and an **optional** integrated CO₂ PPM control mode. The optional PPM-1c controller is the most precise and efficient method of distributing CO₂.

***NOTE: If the PPM-1c is not being used, the jumper-plug supplied with the CO₂-4e must be plugged into the Quick Disconnect on the lower left side of the enclosure in order for the CO₂-4e to function correctly.**

TIMED CO₂ CONTROL MODE

The CO₂-4e uses 4 timers for exhaust and CO₂ control. The four timers are the **Overall Cycle Time, Exhaust Cycle Time, CO₂ Inject Duration**, and the **CO₂ Inject Frequency**.

The **Overall Cycle Time** is the longest amount of time that the CO₂-4e will run without an exhaust cycle. This timer will automatically start an exhaust cycle and disable the CO₂ temporarily. This timer can be set from 1 minute to 8 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 CO₂ efficiency.

The **Exhaust Cycle Time** can be set from 1 second to 40 minutes. As discussed earlier, a thermostat and a dehumidist are used to interrupt CO₂ 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 CO₂ cycle time and prevent "Short-cycling" the CO₂ system. This results in reducing CO₂ waste. Especially useful if the temperature within the growing area increases during the hottest part of the day.

The **CO₂ Inject Duration** can be set from 1 second to 40 minutes. When the CO₂-4e is powered up, the CO₂ cycle begins if the photocell determines that it is daytime. The CO₂ outlet is energized for the time set using the CO₂ Inject Duration timer.

The **CO₂ Inject Frequency** works in conjunction with the CO₂ Inject Duration timer. This timer can be set from 1 minute to 8 hours. During the CO₂ cycle, the CO₂ outlet will be turned off for the amount of time set on this timer. The CO₂ Inject Duration timer and the CO₂ 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 CO₂ is disabled, the exhaust is enabled and the Exhaust Cycle Time begins.

PPM CO₂ CONTROL MODE (OPTIONAL WITH PPM-1c CO₂ MONITOR)

The CO₂-4e can control CO₂ 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 CO₂-4e. This gives you the ability to fully control CO₂ with PPM accuracy. Just set the PPM level on the PPM-1c that you wish to maintain, and the CO₂-4 in conjunction with the PPM-1c will coordinate your CO₂ and ventilation.

The PPM-1c controller consists of an infrared detector capable of measuring CO₂ 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 CO₂ level in the air resulting in a higher reading.

With the PPM-1c connected, the **CO₂ Inject Frequency** doubles as a CO₂ sample timer when using the PPM-1c controller. Because it may take a couple of minutes from the time CO₂ is released for the PPM-1c to detect a higher CO₂ level, this timer will provide a delay for the PPM controller to sense this increase in the CO₂ level before releasing more CO₂. If you find the CO₂ level is overshooting the CO₂ set point, try increasing the **CO₂ Inject Frequency** timer. This will give the PPM-1c more time to sense the rise in CO₂.

***NOTE: Do not start a CO₂ 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 CO₂ outlet never comes on.

Verify the jumper in the CO₂ PPM Sensor is connected.

If you are using a PPM-1c, the "PPM level low" light will be on when the actual measured CO₂ level is below your desired set point. If the "PPM level low" light is not ON the CO₂ outlet will not energized.

If the Exhaust outlet is ON, the CO₂ 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 CO₂ 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 CO₂ is allowed to run for longer amounts of time.

My CO₂ 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 CO₂-4 operates a standard "timed-release" sequence, you may still be wasting CO₂.

If you are operating compressed CO₂ valves, consider purchasing the optional PPM-1c "Part-Per-Million" sensor to upgrade to PPM control. The PPM-1c offers a significant improvement in CO₂ efficiency.

The CO₂ level "overshoots" the PPM-1c set point considerably.

When using the PPM-1c, the CO₂ timers still control the duration of the "ON" and "OFF" time of the CO₂ 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 CO₂ time to "mix" properly with the ambient air and measured by the PPM sensor.

Start with lower CO₂ timer settings for small areas and increase the timer settings for larger ones.

WARRANTY

The CO₂-4e 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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