

Installation and Operation Manual



Electronic Infrared Multi-Fuel Air Cooled Thermal Sink Carbon Dioxide Generator

Introduction

Carbon Dioxide Enrichment will dramatically increase the growth of green plants. Green plants use carbon dioxide (CO₂) and water in the presence of light to synthesize organic compounds. The plant then converts these organic compounds into elements that it can use (food). This process is called photosynthesis. If any of these ingredients (CO₂, water or light) are at levels below what the plant can use for maximum efficiency, it will only be able to perform at that level and no greater. Adding carbon dioxide to a growing environment that is not receiving proper nutrients or is low on light will not produce the desired results. Similarly, plants that are receiving plenty of sunshine and nutrients will only perform as well as the level of CO₂ will allow. The ambient level of CO₂ in the earth's atmosphere is generally between 300 and 400 ppm. Most plants receive far more water and energy in the form of sunshine than they can use. Increasing the CO₂ in the growing area will let the plant use the excess water and energy that is stored in the leaves. The result is a substantial increase in the growth rate of any plant that uses chlorophyll in the process of photosynthesis. Enrichment should commence at sunrise or when photoperiod begins and refrain during darkness hours. The average CO₂ level that is recommended is 1000 to 2000 parts per million (PPM). The object is to maintain a constant level in the atmosphere. You can run a small unit continuously during photoperiods or you can use a larger unit and time it to function periodically. Where exhaust requirements are frequent, the latter method is preferable. After the exhaust function the generator can be cycled to replenish CO₂ quickly to maintain rapid plant photosynthesis. Use the operation time charts to determine the size of generator and the number of minutes of operation required for the level of CO₂ desired. Frequency of recharge depends on the rate of consumption. For the greatest fuel economy and accuracy of recharge it is recommended that a Green Air Products CO₂ Monitor Controller be used with all generator and emitter systems.

Principles of Operation

Carbon dioxide generators operate by burning carbonaceous fuels such as propane or natural gas. The burners used in Green Air Products CO₂ generators are specially designed to maximize the production of CO₂ and minimize heat as a by-product. Green Air Products generators provide CO₂ spark ignition is used to ignite the gas when the generator is turned on. A thermo sensor is used to monitor the burner flame. If the flame is lost, a safety valve will close so that unburned fuel will not be released into the enclosure. CO₂ generator operations may be automatically functioned according to actual ambient values when installed in conjunction with a CO₂ controller. This control device continually samples the level of carbon dioxide in the growing area and functions the generator whenever CO₂ levels do not meet your predetermined values. Generators are easily installed, dependable and efficient. Transformer included. Operates on 110 VAC.

Rules for Safe Operation

- Read and understand the information in this manual before operating the equipment. Observe all CAUTIONS.
- Unit should be operated in a safe, clean and ventilated area free of flammable materials.
- Housing becomes hot under normal operating conditions. To avoid possible burns, never touch equipment during operation.
- To service or repair this unit always disconnect power source and shut off fuel supply.
- Do not operate if gas turns are noticed. It is recommended the fuel tank be located outdoors or in a well ventilated area free of sparks or open flame.
- For service or repair always send the unit back to the factory or an authorized service center.
- Never overfill propane tank. Allow room for expansion of contents due to contrast in temperatures. It is recommended that tank be located outside the enclosure for safest operation. A properly burning flame should burn clean and blue and produce no toxic emissions. Remember a flame requires oxygen to burn so adequate fresh air intake and circulation is important. Always check for leaks after refilling.

CO₂ Generator Propane Consumption Chart

Propane use per hour cu/ft	Propane Tank Size				Generator Output	
	1	5	10	25	MAX BTU/HR	CU/FT CO ₂ /HR
MODEL	Hours of Operating Time					
IR-28	8	4.5	22.5	45	20000	28
IR-42	12	3	15	30	30000	42

This chart is used to determine how long a tank of propane will last. First you look in the left column to pick a model, then follow it across to the propane tank size you have. The number that corresponds with the two selections will be the number of hours that you can operate the CO₂ generator. This chart also shows the LP use in cu/ft per hour for each model and the BTU's and cu/ft per hour of CO₂ produced. Example: a IR-28 will operate for 45 hours on a 10 gal propane tank. If each run cycle is 5 minutes it will run 540 cycles. If you run 20 cycles a day a 10 gal tank will last 27 days.

INFRARED CO₂ GENERATOR SPECIFICATIONS

MODEL	CU/FT CO ₂ /HR	Pounds CO ₂ /HR	BTU's per hr.	Fuel cu/ft/hr	Size LxWxH	Shipping Weight
IR-28	28	3	20000	8	18x12x13	20 lbs
IR-42	42	6	30000	16	18x18x13	25 lbs

AC Power supply - 120/12 VDC 1 amp 2.1 mm plug center positive

FIVE YEAR LIMITED WARRANTY

Green Air Products guarantees that this equipment will perform as implied for the purpose it is intended. Green Air Products warrants the original purchaser of this equipment against defects in mechanical parts and workmanship for 5 years and electrical parts for 90 days. At our option we will repair or replace defective equipment. Warranty service is only performed at the factory or authorized service center. Any usage contrary to proper application or alterations of original construction will void warranty obligations. For further warranty information contact your dealer or Green Air Products service department.

For professional use by qualified personnel in a facility suited for proper operation in compliance with local, state and federal laws



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CO₂ Generator Size and Timing Chart - 1000 PPM

IR-42	IR-28	CU/FT	200	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800
.25	.38	200	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	
.50	.75	400	800	1600	2400	3200	4000	4800							
1	1.5	800	1600	3200	4800										
1.5	2.3	1200	2400	4800											
2	3	1600	3200	6400											
2.5	3.8	2000	4000	8000											
3	4.5	2400	4800	9600											
3.5	5.3	2800	5600	11200											
4	6.8	3200	6400	12800											
4.5	7.6	3600	7200	14400											
5	8.4	4000	8000	16000											
5.5	9	4400	8800	17600											
6		4800	9600	19200											

This chart will give you the minutes of operation required for the areas and models shown. Top row of the chart represents cubic feet of area in the enclosure (LxWxH). The left column is the model size. Model numbers represent maximum CO₂ output per hour in cubic feet (IR-28 = 28 cu/ft/hr CO₂ Example: A IR-28 will take 5 minutes to produce a CO₂ level of 1000 ppm in a 2000 cu. ft. enclosure. The area should be charged as quickly as possible for maximum advantage. Charging the atmosphere quickly insures that the rapid photosynthesis process will not be interrupted and the plants growth rate reduced. Five to ten minutes is a good charge time. Try not to exceed twenty minutes. Your microclimate will need to be recharged every 1 to 4 hours depending on how much CO₂ is lost due to plant usage or drafts (leaks). Large greenhouses logically require longer charge times and multiple units may be necessary. The IR-42 takes 1.25 minutes per 1000 cu. ft. area to charge to 1000 ppm. Therefore a 20,000 cu. ft. area would be 20 X 1.25 which is 25 minutes. For this application that may be an acceptable charge time.

Generator Installation

Use chain, eyebolts and ceiling hooks found in hardware pack. Hang the generator from a sturdy overhead location at least 18 inches from ceiling. The unit must operate in level upright position. "CAUTION" Should unit fall during operation fire may result.

1. For propane applications use a propane tank that has been filled to only 80% of it's capacity. This is very important. An overfilled tank can release fuel from the pressure release valve when placed in a warm room. It is recommended to keep the tank outside the growing enclosure. Failure to observe this common rule could be hazardous and make your generator hard to ignite.

2. Carefully thread the regulator flange nut in the tank valve counterclockwise with your fingers until you feel the flange seat. Tighten firmly with adjustable end wrench. **DO NOT USE PLIERS!** Fasten hose between regulator and generator gas inlet in same fashion.

3. Turn the propane tank valve half open in the "ON" position.

4. Check for gas leaks. A solution of 25% hand dish soap and 75% water in a spray bottle will work well for detecting gas leaks. Apply solution to all previously connected fittings. Bubbles will occur around loose connections. Always use two wrenches when tightening multiple fittings.

NATURAL GAS USE

This model of the IR generator has an adjustable nozzle which enables it to be used for propane (LP) or natural gas (NG). For NG a simple adjustment is necessary. Place generator on a table or floor. With the cooling tubes removed, use the tube holes to get to the orifices. Turn the orifice hex 1/2 turn right (clockwise). Turn only the red orifice tip not the fitting itself. Use the wrench provided or any 1/2 or 13mm wrench. Make similar adjustment to each of the burners. After the initial setting turn ON the generator and inspect the flame. An ideal flame will be a low profile even burn that ignites quickly and transfers ignition to the adjacent burners within approx. 30 seconds. The flame should be a clean blue and the ceramic will turn red after a minute or two. If further adjustment is necessary, very slight corrections are required. Once it is lit you can make subtle adjustments while running. Be careful, it's hot.

There is no regulator necessary for NG when used with a typical household utility. Normal household appliance pressure is 4 to 7 water columns. Set aside the LP tank regulator and use the 1/2 inch pipe fitting (included) to connect to your gas source. Use a pipe compound when connecting to gas pipes. **DO NOT** use teflon tape. **DO NOT** use anything on brass to brass hose connections.

Igniting Burners

1. Plug the transformer into a 110 volt outlet, timer, CO2 controller, or other power source. Make certain power is on.

2. Turn gas supply on. Push the red on-off switch to the "ON" position. The igniter will begin to spark. It may take a moment to clear the air from the hose. Fuel will pass through the solenoid valve and the burners will ignited.

3. The spark igniter will automatically cycle three attempts to light the burners. If a flame is not present it will cease to spark. Check for fuel, wait 60 seconds for excess fuel to clear from housing and reset on-off switch to cycle igniter electrode again. You will see a rapid visible spark between the igniter electrodes or to the burner tube itself.

TROUBLE SHOOTING TIPS

BURNER FAILS TO IGNITE:

Make sure propane tank has fuel and valve is open. For natural gas generators make sure gas supply is "On" and your gas supply shut off valve is open. Make sure propane tank has not been overfilled. If so, take tank outdoors and open valve to release gas for a few seconds and reconnect. Be sure all air has bled from the hose and gas is present. Check that transformer is plugged into a working power source. Make sure power switch is in "ON" position. Check to see that nothing is interfering with igniter probe. It may be necessary to adjust location of the igniter to the burner. The spark probe should be no more than 1/8 inch above the burner ceramic surface. Spark wire shorting to housing. Spark module faulty. Air blowing on burner disrupting fuel.

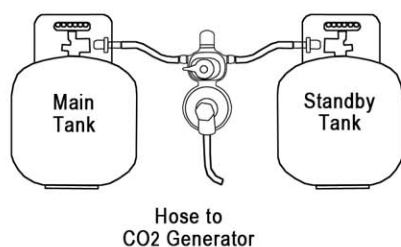
BURNER WON'T STAY LIT:

Flame too small. Not enough fuel to burner - adjust orifice. Spark probe tip not in flame. Air in fuel line - bleed. Ignition module faulty - replace. Air blowing on burner.

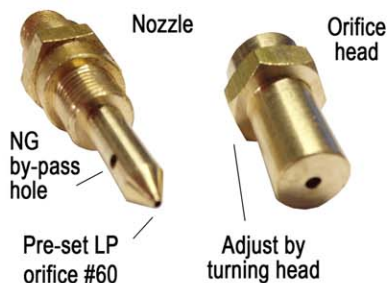
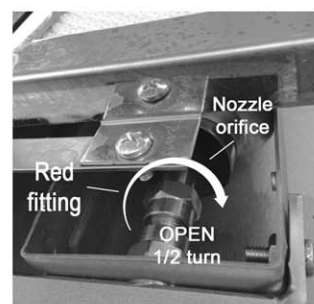
FLAME BURNS IRREGULAR:

Dirt or residue could constrict burner orifice. Low fuel pressure due to depleted or contaminated fuel supply. Lack of oxygen content in room due to inadequate fresh air intake. Excessive air movement or gust from fan or ventilation. Generator not setting level. The flame should be a strong blue color about 1/2 inch high. Flickers of yellow are normal however constant yellow tips indicate improper burn. Contact Green Air Products service department for solutions.

AUTOMATIC PROPANE CHANGEOVER VALVE - LPCV (optional accessory)



This handy valve will keep you from running out of fuel and interrupting CO2 enrichment. When fuel is depleted in main tank the valve switches to the alternate tank and indicator shows red. Disconnect spent tank and refill at your convenience.



Control Diagrams



This example shows the simplest method of CO2 generator control. Set the Cyclestat-4P for short intervals according to the minutes determined in the size and timing chart. We cannot chose for you how often to cycle the generator because that depends on your enclosure and ventilation characteristics. Once every hour is a very general schedule. Cyclestat will limit operation during light hours only.

For an exhaust synchronized CO2 system see the diagram below



This diagram demonstrates an exhaust synchronized system where the CO2 equipment is disabled during exhaust functions and immediately replenished when exhaust is completed. The CT-DH-3 temperature and humidity controller activates the exhaust fan and shuts off the CO2 during the exhaust cycle. Enrichment will only occur when exhaust fan is off and light is present. The CO2 "On" cycles are timed by the Cyclestat repeat cycle timer which cycles the CO2 equipment according to your preset periods. It has a built in photo sensor to limit CO2 enrichment to photoperiods only. An example might be that the timer is set for 5 minutes every hour. The CO2 generator would be operated according to that hour schedule. In the event that there is an exhaust function at any time the CO2 will come on for 5 minutes immediately after the exhaust cycle is completed. It will repeat again one hour after that point. Replenishment of CO2 will always follow an exhaust cycle to maintain a constant and continuous enrichment level.

The Ultimate CO2 Control System



This system is the ultimate in precise automated CO2 control. The SPC-1 CO2 Set Point Controller continuously determines atmospheric CO2 values. The controller interprets these values and provides flexible set point adjustments to sequence CO2 equipment functions. The SPC-1 has a built in photo sensor to disable CO2 production during darkness. The CT-DH-3 temperature and humidity controller defeats CO2 production during exhaust functions. The CO2 generator (or emitter system) and the monitor are plugged into the CT-DH-3 as shown. The power to the generator will be interrupted whenever the temperature or humidity conditions constitute an exhaust function. CO2 production will resume immediately after exhaust cycle is completed. CO2 levels will be maintained precisely and automatically.

Also see our website for information on the CDMC-6 Carbon Dioxide Monitor Controller for highly specialized enrichment control.

Air Cooled Operation

Highly recommended optional accessory

One of the most innovative special features of the new Electra-Air Generator is the highly efficient internal fin aluminum heat exchanger tube. When installed over the burner it absorbs heat from the CO2 before it can become an atmospheric concern. Effective enough to remove over 25% of the heat depending on varying installation characteristics. Brought to you by the same people who invented the air cooled lamp canopy the principle is the same. Bring in outside air through 4" ducting, attach to the heat sink tube on the generator and vent the hot air to an adjoining area where the heat can be utilized for beneficial advantage. Use at least a 400 cfm duct fan for cooling tube air flow.



Optional heat removal tube

Slides easily into housing

Optional duct adapters