

**OPERATING INSTRUCTIONS FOR
LEEC AUTOMATIC CO2 INCUBATORS**

**MODELS GA2000 and GA2010
MODELS GA3000 and GA3010
With Infrared CO2 detectors**

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1.0 GENERAL DESCRIPTION

Thank you for choosing LEEC. We trust your purchase will give you many years of trouble-free use.

1.1 CO₂ CONTROL

The CO₂ concentration is controlled to a preset level with an accuracy of better than 0.2% CO₂ in air. The CO₂/air mixture is continuously monitored and the current chamber %CO₂ is shown on a digital display. An Infrared (IR) CO₂ sensor is used to detect the CO₂ levels. If the CO₂ level is below the required set point, the control system opens a solenoid valve to inject CO₂ gas into the chamber to bring the chamber atmosphere back to the set level. When the door has been opened, two-stage recovery of the CO₂ level starts. This is achieved by controlling both coarse and fine flow of CO₂ into the incubator chamber until a preset CO₂ level has been reached. The fine flow then brings the CO₂ level gently up to the correct %CO₂ set point without overshooting. Whilst the door is open, the chamber circulating fan, heaters and CO₂ inlet solenoid valves are automatically shut off to prevent wastage.

1.2 HEATING

Low wattage heaters are bonded to the outer surface of the inner chamber, using a LEEC patented arrangement. A door heater prevents the inner glass door(s) from condensating during high humidity operation. This keeps the view into the chamber clear.

1.3 COOLING

A cooling coil is built in to your incubator which, when connected to a **LEEC Self Contained Recirculating Cooler**, allows the incubator to operate at temperatures near or below ambient.

1.4 TEMPERATURE CONTROL

The temperature is accurately controlled by a LEEC microprocessor system. Multiple sensors inside the chamber and door ensure fast recovery and very stable control. Users are able to adjust the temperature set point, low and high alarm levels, alarm delay time and the over temperature safety cut out.

1.5 CIRCULATING FAN

A fan located at the top of the chamber blends the chamber atmosphere. This circulation fan ensures that the mixture of gas is precise, which is essential for sampling purposes. A small amount of heat produced by the fan raises the chamber temperature by approximately 5°C. A door micro switch stops the fan when the outer door is opened.

1.6 HUMIDITY

Very high humidities up to approximately 98% RH are achieved by flooding the base of the chamber with distilled water to a depth of approximately ½ to 1 Cm. Alternatively, the chamber can be used “dry” with no additional water without the need for recalibration.

1.7 HIGH TEMPERATURE DECONTAMINATION (Research models only)

Models GA2000 and GA3000 are fitted with a high temperature decontamination facility as standard. An additional heating element raises the chamber air temperature to approximately 95°C to decontaminate the chamber. This can be performed as often as you like. **See section 11.0 for more details.**

1.8 **FUSES**

A 6.13A fuse next to the power cable entry point limits the current that the incubator can draw. There are additional internal fuses located under the removable lid for the main chamber heaters, door heater and decontamination system (GA2000 & GA3000 models only).

1.9 **ALARMS**

The LEEC multifunction controller incorporates a comprehensive alarm system. There are over and under alarms for both temperature and CO₂, which activate a buzzer and start the displays flashing. Your incubator is also fitted with a remote alarm socket which provides volt-free change over contacts for switching any remote alarm (e.g. Building Management System) that you may connect to it.

All models are fitted with an independent over heat safety cut out which is independent of the main controller has a separate sensor.

2.0 INSTALLATION AND SET UP

2.1 Your LEEC CO₂ incubator must be installed in suitable location. It should be placed on a firm flat surface such as a laboratory bench, LEEC stacking frame or the floor. All models have adjustable feet at the front. An adjustable spanner is required if the feet need adjusting. A spirit level should be used to check for level.

2.2 Do not locate the incubator in direct sunlight or near heat sources.



LEEC CO₂ incubators use Carbon Dioxide gas, which can be harmful to your health. It is important to provide sufficient ventilation to ensure that the gas flowing out of the side ports is not allowed to build up in the laboratory or room where the incubator is located.

2.3 ELECTRICAL

LEEC CO₂ incubators should only be connected to a 240V AC, 50Hz power outlet. A UK 3-pin moulded plug and power cable is fitted as standard. The wiring colour inside the power cable is as follows:

- **BROWN** = **LIVE**
- **BLUE** = **NEUTRAL**
- **GREEN/YELLOW** = **EARTH**

2.4 CO₂ GAS SUPPLY

The CO₂ gas inlet nozzle is located at the back right hand corner. **Ordinary commercial CO₂ gas should be used at 1 p.s.i. (0.06 bar).** Never use liquid CO₂ cylinders. LEEC can supply suitable pressure reducing valves with a 0-30 p.s.i. downstream gauge, to reduce the gas pressure to the correct level. Connect the incubator to the CO₂ supply using clear plastic tubing. Rubber hose or the use of jubilee clips is not recommended.



It is important that the incoming CO₂ supply pressure is 1 p.s.i. Higher pressure than this will cause the CO₂ control system to overshoot. Excessive pressure (i.e. over 120 p.s.i. / 8.0 bar) could damage the incubators sensitive Infrared CO₂ detector system.

2.5 START UP

Check that the power cable and CO₂ connection has been connected correctly. Turn the incubator ON by pressing the green **Power On** button. The green button will illuminate when the power is switched on. All display elements will light up, perform a self test and the display will show LEEC 20.2.

3.0 DESCRIPTION OF CONTROLS - SEE DIAGRAM 1.0



GA2000 / GA3000 control panel

3.1 **Power On BUTTON (green)**

This is located on the right hand side of the front control panel and switches the incubator ON and OFF. Press to switch ON. The green lamp will illuminate. Press again to switch OFF. The green lamp will extinguish.

3.2 **CO2 On BUTTON (amber)**

This button controls the power to the CO2 solenoid valves. Press to switch ON and the amber lamp will illuminate. Press again to switch OFF. When activated, this switch will allow the solenoids to inject CO2 into the chamber if the control system demands it. Alternatively, this button can be switched OFF if just the CO2 display is required to indicate the CO2 level without controlling the gas.

Note: The outer door must be closed for the CO2 supply solenoids to function.

3.3 **DECONTAMINATE KEY (models GA2000 & GA3000 only)**

This key switch on the control panel initiates decontamination (see section 11.0).

3.4 **OVERHEAT ALARM (audio & visual)**

The alarm will illuminate red when the independent overheat cut out is activated, and will only clear when the fault has been cleared.

3.5 **ENTER / RESET BUTTON**

This button has two functions: 1) To MUTE the alarm buzzer when activated. 2) To enter values when adjusting the operating parameters by pressing and holding it until a confirmation "beep" is heard.

3.6 **BUTTON (INCREASE VALUE)**

This button increases the display value. Press and release and the value increases by 0.1. Press and hold for fast increases.

3.7 **BUTTON (DECREASE VALUE)**

This button decreases the display value. Press and release and the value decreases by 0.1. Press and hold for fast decreases.

3.8 **TEMPERATURE DISPLAY**

This displays the chamber temperature during normal running. It is also used in the setting of various parameters (see section 5.0). The displays will flash if there is a temperature alarm and will only clear when the fault has been cleared.

3.9 **°C SET BUTTON**

This button is used to set various temperature parameters. Press repeatedly to scroll through the various parameters.

- 3.10 ● **Heater LED**
This amber LED shows when the chamber heater is working. It flashes during normal operation.
- 3.11 ● **Door LED**
This amber LED shows when the door heater is working. It flashes during normal operation.
- 3.12 ● **Decon. LED (models GA2000 & GA3000 only)**
This amber LED shows when the decontamination cycle is active.
- 3.13 **% CO2 DISPLAY**
This displays the chamber %CO2 reading during normal running. It is also used in the setting of various parameters (see section 5.0). This display will flash if there is a %CO2 alarm and will only clear when the fault is cleared. When the %CO2 is set to 0.0, the %CO2 alarms are automatically deactivated.
- 3.14 **% CO2 SET BUTTON**
This button is used to set various %CO2 parameters. Press repeatedly to scroll through the various parameters.
- 3.15 ● **Fine LED**
This amber LED shows when the FINE CO2 solenoid valve is injecting CO2 gas into the chamber.
- 3.16 ● **Coarse LED**
This amber LED shows when the COARSE CO2 solenoid valve is injecting CO2 gas into the chamber.

4.0 OPERATING PROCEDURE FOR NORMAL RUNNING

- 4.1 Firstly follow the installation and set up procedure (Section 2.0).
- 4.2 Check the CO2 button is OFF (i.e. not illuminated)
- 4.3 Adjust the CO2 set level to 0.0 (Section 5.7) to mute all %CO2 alarms during set up.
- 4.4 Adjust the °C set point to required temperature (Section 5.1)
- 4.5 **(Optional step - humidification)** You can add distilled water to the base of chamber to humidify the chamber atmosphere if required. If you do not require high levels of humidity in the chamber, skip this step.
- 4.6 Allow the temperature to stabilise for at least 12 hours before putting into use.
- 4.7 Adjust CO2 set point to the required CO2 percentage (Section 5.7).
- 4.8 Switch CO2 button ON and wait for the CO2 to stabilise.

5.0 SETTING USER OPERATING PARAMETERS

The temperature and CO2 concentration inside the chamber can be set by the user. In addition, various alarm parameters can also be adjusted. This section describes the functions and the procedures and how to change them. There is also an Engineering Mode which can only be accessed by trained service personnel.

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See Paragraph	Control Parameter	Indication on Display	Description	Unit
5.1	Temperature Set Point	SP_t 37.0	Sets chamber temperature set point	°C
5.2	Temperature Low Alarm Level	lo_t -1.0	Sets temperature low alarm level relative to set point	°C
5.3	Temperature High Alarm Level	hi_t 1.0	Sets temperature high alarm level relative to set point	°C
5.4	Temperature Alarm Delay time	tdEL 12.0	Sets Delay Time for temperature alarm	1 = 100 seconds
5.5	Safety Cut Out Temperature	cut_ 40.0	Sets independent Safety Cut Out temperature	°C
5.6	Temperature Offset	oFFS	Adjust to correct a mis-reading temperature display	°C
5.7	CO2 Set Point	SP_c 0.0	Sets chamber CO2 set point	% CO2
5.8	CO2 Low Alarm Level	lo_c -1.0	Sets CO2 low alarm level relative to set point	% CO2
5.9	CO2 High Alarm Level	hi_c 1.0	Sets CO2 high alarm level relative to set point	% CO2
5.10	CO2 Alarm Delay Time	c_dEL 12.0	Sets delay time for high & low CO2 alarms	1.0 = 100 seconds
5.11	CO2 Offset	Offs 0.0	Adjust to correct a mis-reading CO2 display	% CO2

5.1 Temperature Set Point

Command	Action	Displays		Remarks
		CO2	Temp	
Display temperature set point	Press °C Set button once	SP_t	37.0	Unit factory set to 37.0°C
Select temperature set point	Press ▼	SP_t	xx.x	Value decreases
	Press ▲	SP_t	xx.x	Value increases (where xx.x is new value)
Save new selected value	Press ◀ and hold until beep	SP_t	xx.x	Saves value and returns to normal display

5.2 Set Temperature Low Alarm Level

Command	Action	Displays		Remarks
		CO2	Temp	
Display temperature low alarm level	Press °C Set button twice	lo_t	-1.0	Low alarm levels are negative increments from set point
Select temperature low alarm level	Press ▼	lo_t	xx.x	Value decreases
	Press ▲	lo_t	xx.x	Value increases where xx.x is new value
Save new selected value	Press ◀ and hold until beep	lo_t	xx.x	Saves value and returns to normal display

5.3 Set Temperature High Alarm Level

Command	Action	Displays		Remarks
		CO2	Temp	
Display temperature high alarm level	Press °C Set button 3 times	hi_t	1.0	High alarm levels are positive increments from set point
Select temperature high alarm level	Press ▼	hi_t	xx.x	Value decreases
	Press ▲	hi_t	xx.x	Value increases (where xx.x is new value)
Save new selected value	Press ◀ and hold until beep	hi_t	xx.x	Saves value and returns to normal display

5.4 Set Temperature Alarm Delay Time

Command	Action	Displays		Remarks
		CO2	Temp	
Display temperature alarm delay time	Press °C Set button 4 times	tdEL	12.0	tdEL sets delay for temperature low alarm. There is no delay on the high temperature alarm
Select Temperature Alarm Delay Time	Press ▼	tdEL	xx.x	Value decreases
	Press ▲	tdEL	xx.x	Value increases (where xx.x is new value)
Save new selected value	Press ◀ and hold until beep	tdEL	xx.x	Saves value and returns to normal display

5.5 Set Safety Cutout Temperature

Command	Action	Displays		Remarks
		CO2	Temp	
Display safety cutout temperature	Press °C Set button 5 times	cut_	40.0	Sets independent over temperature safety cutout
Select safety cutout temperature	Press ▼	cut_	xx.x	Value decreases
	Press ▲	cut_	xx.x	Value increases (where xx.x is new value)
Save new selected value	Press ◀ and hold until beep	cut_	xx.x	Saves value and returns to normal

5.6 Set Temperature Offset

Command	Action	Display		Remarks
		CO2	Temp	
Display temperature offset	Press °C Set button 6 times	oFFS	0.0	Adds offset to temperature display reading
Select temperature offset	Press ▼	oFFS	xx.x	Value decreases
	Press ▲	oFFS	xx.x	Value increases (where xx.x is new value)
Save new selected value	Press ◀ and hold until beep	oFFS	xx.x	Saves value and returns to normal

5.7 Set CO2 Gas Operating Level

Command	Action	Displays		Remarks
		CO2	Temp	
Display CO2 level set point	Press CO2 Set button once	SP_c	0.0	Sets % CO2 operating level. CO2 level is factory set to 0.0% to disable all CO2 alarms
Select CO2 level set point	Press ▼	SP_c	xx.x	Value decreases
	Press ▲	SP_c	xx.x	Value increases (where xx.x is new value)
Save new selected CO2 level set point	Press ◀ and hold until beep	SP_c	xx.x	Saves value and returns to normal display

5.8 Set CO2 Gas Low Alarm Level

Command	Action	Displays		Remarks
		CO2	Temp	
Display CO2 low alarm level	Press CO2 Set button twice	lo_c	-1.0	Low alarm levels are negative increments from %CO2 set point
Select CO2 low alarm level	Press ▼	lo_c	xx.x	Value decreases
	Press ▲	lo_c	xx.x	Value increases (where xx.x is new value)
Save new selected CO2 low alarm level	Press ◀ and hold until beep	lo_c	xx.x	Saves value and returns to normal display

5.9 Set CO2 Gas High Alarm Level

Command	Action	Displays		Remarks
		CO2	Temp	
Display CO2 high alarm level	Press CO2 Set button 3 times	hi_c	1.0	High alarm levels are positive increments from %CO2 set point
Select CO2 high alarm level	Press ▼	hi_c	xx.x	Value decreases
	Press ▲	hi_c	xx.x	Value increases (where xx.x is new value)
Save new selected CO2 high alarm level	Press ◀ and hold until beep	hi_c	xx.x	Saves value and returns to normal display

5.10 Set CO2 Gas Alarm Delay Time

Command	Action	Displays		Remarks
		CO2	Temp	
Display CO2 alarm delay time	Press CO2 Set button 4 times	cdEL	12.0	Sets delay time for both high and low %CO2 alarms
Select CO2 alarm delay time	Press ▼	cdEL	xx.x	Value decreases
	Press ▲	cdEL	xx.x	Value increases (where xx.x is new value)
Save new selected CO2 alarm delay time	Press ◀ and hold until beep	cdEL	xx.x	Saves value and returns to normal display

5.11 Set CO2 Offset

Command	Action	Displays		Remarks
		CO2	Temp	
Display CO2 offset	Press CO2 Set 5 times	oFFS	0.0	Adds positive or negative offset to %CO2 reading
Select CO2 offset	Press ▼	oFFS	xx.x	Value decreases
	Press ▲	oFFS	xx.x	Value increases (where xx.x is new value)
Save new selected value	Press ◀ and hold until beep	oFFS	xx.x	Saves value and returns to normal display

Notes:

- 1) Press and release of ▼ or ▲ decreases or increases the value by 0.1. Pressing and holding down either of these buttons makes the value change quickly.
- 2) Leaving any button unpressed for more than 5 seconds makes the display go back to normal mode.

6.0 CHECKING TEMPERATURE CALIBRATION

- 6.1 The incubator has been factory calibrated and should not need recalibration other than on a planned maintenance schedule.
- 6.2 To check the chamber temperature calibration, place a known calibrated temperature monitoring device in the centre of the chamber. Allow the conditions in the incubator to stabilise for at least 1 hour before taking any readings.
- 6.3 Any difference between the measured temperature and the actual chamber temperature can be corrected by entering an offset value (See Section 5.6). **The default Offset value is factory set 0.0.**

Note: A **positive** offset valve will **add** an offset value to all readings.
A **negative** offset valve will **subtract** an offset value from all readings.

7.0 CHECKING CO2 CALIBRATION

The incubator has been factory calibrated for operation at 37.0°C and 5.0% CO₂ and should not need recalibrating other than on a planned maintenance schedule.

7.1 CHECKING CO2 LEVELS

LEEC offers a range of hand held CO₂ calibration devices for independent checking of the chamber CO₂ levels. Please contact LEEC or visit the LEEC website www.leec.co.uk for more details.

8.0 HUMIDIFICATION

- 8.1 LEEC Infrared CO₂ incubators can now be used fully humidified, partially humidified or dry (e.g. ambient level of humidity) without affecting the CO₂ calibration. To obtain a high level of humidity inside the chamber, ensure that the base of the chamber is kept fully covered with distilled water at all times. This will keep the relative humidity at approximately 98% RH. Using a small removable plastic tray / pot of water will give a lower level of humidity in the chamber. Use as much or as little water as you like.

9.0 COOLING COIL

- 9.1 A cooling coil is built in to your incubator which, when connected to a **LEEC Self Contained Recirculating Cooler**, allows the incubator to operate at temperatures near or below ambient. The coil is located near the fan at the top of the chamber behind a false panel to give maximum efficiency. The coil inlet and outlet are located in the recessed area at the back right hand corner of the incubator. The coil should be connected to a source of liquid 5°C or 10°C cooler than the required chamber temperature. **LEEC Self Contained Recirculating Cooler** units are recommended for this purpose. Please contact LEEC for details.

10.0 MAINTENANCE AND CLEANING

- 10.1 LEEC CO₂ incubators, whilst being relatively complex, do not require any routine maintenance, but regular cleaning of the inner chamber and outer cabinet using a damp cloth and mild detergent solution is recommended. Switch off the incubator when cleaning the inner chamber.

The shelves, false top, false back panels and Infrared CO₂ probe can all be easily removed for cleaning purposes. To do this, first remove the shelves and their runners, the false back can then be removed by pulling upwards on the bottom lip. To remove the false top, first undo the screws at the left and right on the front of the panel, then taking care not to catch the circulating fan blades, slide the false top panel away from the chamber to remove it. To re-assemble, simply reverse the above procedure.

In the event of spillage of hazardous chemicals or materials, use the appropriate decontamination method as prescribed by the HSE or your local Safety Officer. If you have any questions, contact LEEC for advice.

10.2 LONG TERM STORAGE



When switching off the incubator for any prolonged period (e.g. long term storage) it is essential to purge any remaining moisture from the CO₂ detector probe. This is achieved by removing all the water from the chamber and running for 3-4 hours in a dry condition.

10.3 ACCESS PORTS



Do not under any circumstances completely seal both access ports on the right hand side of the incubator (red threaded bungs). Normally one port is completely sealed and the other has a hole in the red plastic cap which allows the displaced air to escape when CO₂ gas is injected into the chamber.

10.4 CHAMBER CORROSION

Inner chambers of LEEC CO₂ incubators are made from the finest quality stainless steel available. However, corrosion can still result from the improper use of fungicides and bactericides. Chlorine based chemicals used for cleaning can cause permanent damage to the chamber and this is not covered by the warranty as no stainless steel is completely resistant to chlorine.

11.0 HIGH TEMPERATURE DECONTAMINATION (Research models only)

Models GA2000 and GA3000 are fitted with a high temperature decontamination facility as standard. An additional heating element raises the chamber air temperature to approximately 95°C to decontaminate the chamber. This can be performed when required.



A safety device is fitted to LEEC Research CO₂ incubators which prevents users from starting a decontamination cycle with the Infrared (IR) probe still connected. Decontamination can only take place once the IR probe has been removed. **See section 11.3 for information.**

11.1 DECONTAMINATION PROCEDURE

11.2 Remove any samples / work / plastic containers from the chamber. Leave the humidifying water in the incubator chamber as this helps with the sterilisation procedure.

11.3 Remove the securing cable tie. Unscrew and remove the Infrared (IR) CO₂ probe from the top of the chamber and store it safely during the decontamination cycle. The Infrared (IR) probe will be fatally damaged if exposed to temperatures above 60°C. The Infrared (IR) probe is connected to an orange cable at the top of the chamber. When unplugged the CO₂ display will display a random figure. Use the red cap (supplied) to seal the orange cable connector.



11.4 Turn the amber **CO₂ button** OFF.

11.5 Using the provided key, turn on the **Decontaminate** switch. The **Decon.** LED will illuminate when this is in operation, and the display will read dECON. Allow the temperature to rise and maintain for 2 to 4 hours.

11.6 Switch off the **Decontaminate** switch and allow the chamber to cool down to normal operating temperature.

11.7 If required, repeat the decontamination cycle 24 hours later. User experience shows that a second exposure to moist, high temperature almost always eliminates stubborn fungal contamination.

11.8 After the chamber has cooled down, carefully re-connect the Infrared (IR) CO₂ probe and re-secure with a new cable tie (supplied). Store the red removable cap safely. The CO₂ display should read 0.0% CO₂.

11.9 Turn the amber **CO₂ button** ON and allow the incubator chamber conditions to stabilise before use.



WARNING

Do not open the inner glass door at any point during the decontamination cycle or when the chamber is still above 50°C as scolding from the steam could result.

NOTE: When in decontamination mode, the fan speed increases and runs permanently. It will not stop when the outer door is opened. The over temperature alarm buzzer and LED are also deactivated.

**GA2000, GA2010, GA3000, GA3010
FACTORY DEFAULT PARAMETERS**

Temperature	Value
SP_t	37.0
lo_t	-1.0
hi_t	1.0
tdEL	12.0
cut	40.0
oFFS	0.0
CO2	Value
SP_c	5.0
lo_c	-1.0
hi_c	1.0
cdEL	12.0
oFFS	0.0