



170 Litre CO₂ Incubator

User Manual

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GS Biotech Ltd.
Unit 6, Ailsa Industrial
Ailsa Road

Irvine, Ayrshire
Scotland
KA12 8LN, UK

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CAUTION!

This equipment *must* be operated as described in this manual. If operational guidelines are not followed, equipment damage and personal injury *can* occur.

Please read the entire manual before attempting to use this equipment.

Do not use this equipment in a hazardous atmosphere or with hazardous materials for which the equipment was not designed.

GS Biotech are not responsible for any damage to this equipment that may result from the use of an accessory not approved by GS Biotech.

Manual Conventions



NOTE:

Notes contain information deserving special attention.



CAUTION!

Caution messages appear before procedures which, if caution is not observed, could result in damage to the equipment.



WARNING!

Warning messages alert you to specific procedures or practices which, if not followed correctly, could result in serious personal injury.

Bold

Text in boldface type emphasises key words or phrases.



This particular *Warning* message, whether found in the manual or on the unit, means **HOT SURFACE**—and therefore represents a potential danger to touch.



CRUSH WARNING!

Crush Warning messages alert you to specific procedures or practices regarding heavy objects which, if not followed correctly, could result in serious personal injury .

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1 INTRODUCTION

The GS Biotech range of CO₂ incubators are microprocessor controlled and designed to ensure accurate and reliable operation. Each unit incorporates a large, back-lit LCD display, touch-sensitive keypad and sophisticated control system offering easy programming, control and monitoring of chamber conditions. The display also provides on-screen messaging to simplify operation and maintenance.

A direct heating system, utilising a thermal heating element, completely surrounds the chamber, providing an even temperature within the chamber. The independently and directly heated outer door maintains an even distribution of heat. This enables a rapid, controlled return to optimum chamber conditions after a door opening, while also preventing overshoot.

A solid-state infrared sensor controls the level of CO₂, providing excellent reliability - unaffected by humidity. The CO₂ system has a programmable automatic zero system (Auto-reference) to re-reference the sensor baseline to atmospheric CO₂ levels at regular intervals. A small pump supplies HEPA-filtered atmospheric gas to the sensor. The chamber atmosphere within the sensor is displaced, allowing the control system to reference the sensor. This switches off, allowing the chamber atmosphere to homogenise back into the sensor. This provides for accurate CO₂ control with minimal disturbance to the chamber environment.

An integrated humidity system provides a uniform relative humidity, while preventing condensation in other parts of the chamber.

The 170-litre chamber is seamless, providing a sanitary and easy-to-clean environment, all internal components are manufactured from polished stainless steel. The shelves, shelf racks and humidity tray are easily removed without tools for thorough cleaning and can be sterilised. Air circulation is achieved without a fan, eliminating ductwork (a potential source of contamination), simplifying cleaning, eliminating vibration, and reducing small sample evaporation within the chamber.

The incubator incorporates a two-level alarm system. The chamber-monitoring alarms are programmable and will alert you if temperature or CO₂ have not recovered within a preset time after the door has been opened. If not required, this system can be disarmed. The system alarms occur only if a problem has developed with system components that require user intervention to rectify. The incubator also incorporates an over-temperature safety system that operates independently from the main control system.

The incubator features multiple options that can be installed to simplify maintenance and provide superior control over experimental conditions. For example, a humidity tray warning system warns the user before the humidity tray runs out of water, preventing dehydration of samples. Oxygen control provides below-ambient oxygen levels.

These, and other options and accessories provide a uniquely flexible CO₂ incubator capable of meeting the most demanding requirements.

Unpacking & Installation

1.1 Inspection of Boxes

After you have received your order from GS Biotech, inspect the external packaging for any transit damage. Report any damage to the carrier and to your local GS Biotech distributor immediately.

1.2 Unpacking



WARNING!

At least two people are required to safely lift your incubator.

Carefully remove the protective packing. Keep the packing materials, and this User Guide for future reference.

To simplify lifting the incubator, leave it on the pallet. Have at least one person either side to safely lift the unit. *Supported by the base only*, lift the incubator from the delivery pallet.



NOTE:

Locate and remove parts stored in the Humidity Tray.

If any part of your order was damaged in transit, or fails to operate, please contact your GS Biotech distributor.

Using the packing list to verify the correct parts / accessories etc have been received, and nothing is missing.

Table 1 on the following page outlines the accessory items that are supplied with your new incubator.

Table 1: Accessories Provided

Quantity	Item	Notes
4	Non-tip Shelves	Packed in situ
2	Wire Shelf Racks	Packed in situ
1	Humidity Tray	Wrapped in situ
1	White porous CO ₂ Sensor Cover	Installed
1	Black Sensor Cover*	Installed
1	Power Cord	Bag of accessories
3 meters, 9.8 feet	PVC Tubing, ~1/4-inch or 6mm bore, with an inline CO ₂ HEPA-filter connected, ready for use	Bag of accessories
2	Hose Clips	Bag of accessories
1	Auto-zero HEPA Filter	Bag of accessories
1	User Manual	Provided
3	Silicone split tubing shelf rack grips	Installed
3	Press fit silicone feet protectors	Installed

1.3 Utilities

In order to use the incubator, you will need:

Table 2: Utilities

Utility	Requirement
Electricity	220/240V, 50 Hz grounded electrical supply - minimum capacity 10 amps
CO ₂ Gas	Cylinder with 100% CO ₂ vapour withdrawal, together with a two-stage regulator for pressure control to 5 psi or 0.35 BAR

1.4 Location

The incubator is designed to operate at a chamber temperature of 4.0°C above ambient (minimum ambient temperature of 15°C if the unit is being used at 37°C, absolute maximum ambient temperature 41°C)

Care should be taken to **avoid** placing the incubator in a position that may affect its performance, such as those listed below.

DO NOT place the incubator:

- Directly under, beside or within the air-flow of heating or air-conditioning ducts, or other draughts;
- Directly beside heat generating equipment such as a heater, an autoclave or oven;
- Near the exhaust of heat- or cold-generating equipment (like a ULT freezer);
- Near a window exposed to direct sunlight.
- Directly on top of any heat-generating apparatus.
- In a location without a minimum 50mm gap all-round, to allow access to the mains ON / OFF switch and to allow for door opening.

The operating temperature range indicated above excludes any heat generating equipment operating within the unit. The presence of any such appliance will affect the operational temperature characteristics.

**WARNING!**

High CO₂ / Nitrogen Levels! These gasses could potentially cause asphyxiation if a great enough concentration were able to build up! Although the volume of gas contained in the sealed incubator chamber poses no risk, the control system also incorporates a number of user programmable audio / visual alarms – an escape of gas or fault with any bulk storage system used to supply the incubator(s) *could* pose such a risk. Any gases that may escape from the unit in normal operation can be safely managed via adequate natural room ventilation or the use of local exhaust ventilation. Ensure compliance with any maximum permitted workplace concentration or SOP for CO₂ or Nitrogen. Carry out your own risk assessment. Consider installation of an Oxygen level measuring / alarm system to warn if the Oxygen level were to fall to a dangerous level.

1.5 Installing the Feet

To ensure adequate airflow, the incubator feet *must* be installed. *More than one person* is required to perform this operation.

To insert the adjustable feet:

1. Make sure the locking nuts are installed onto each of the four feet provided.
2. Beginning with the front pair: tilt the incubator toward the back, and screw the feet in, to the required depth.
3. Tilt the incubator forward to install the rear pair of feet.

1.6 Install the wire shelf racks and shelves:

1. Each wire shelf rack has silicone suction cups and split tubing to hold the rack in place. Attach the feet and the split silicone tubing sections to each shelf rack in the positions shown below. Leave a gap of approximately 10mm ($\frac{1}{2}$ inch) between the bottom of the silicone tubing and the bottom shelf rung. This will allow the bottom shelf to be inserted with ease.
- 2.



Place the shelf racks in the incubator chamber, making sure that each rack's rear suction cover is pressed firmly against the rear of the chamber, and that each piece of silicone tubing is touching the chamber wall.

Beginning with the bottom shelf, install shelves. Each shelf must be properly inserted onto each shelf rack guide. For orientation, the front edge of the shelf faces downward, while the back edge of the shelf faces upward.



1.7 Making Connections



WARNING!

Before making any electrical connections, verify that your power supply matches that of your unit and that the ON/OFF switch is in the OFF position.

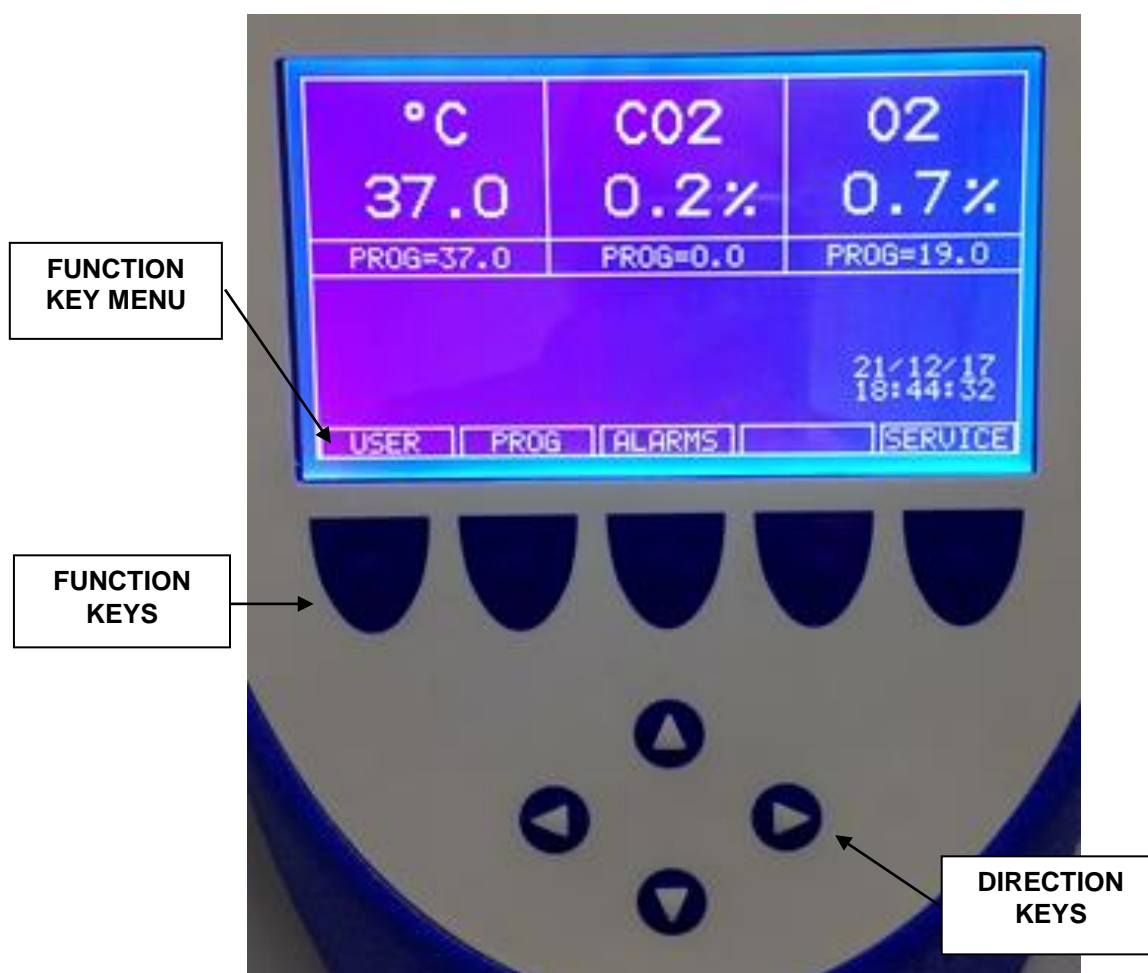
Install the power cord:

1. Verifying the supply voltage matches that of the incubator, and the ON/OFF switch is OFF, connect the cord to the power supply outlet.
2. Insert the power cord into the socket at the rear of the incubator.

2 OPERATION

2.1 Control Panel

The control panel consists of an LCD display, five function keys & four direction keys:



The illustration above shows the screen in normal operation. This is also how the screen should look when you switch the incubator on.

The purpose of each Function Key is identified at the bottom of the display (above each key); the function may change from screen to screen.

The cluster of four arrowed Direction Keys will move the cursor around the screen and adjust values.

2.2 Preparing for Operation

1. Remove the black protective cover from the CO₂ sensor, and keep it in a safe place. The sensor cap should be placed over the sensor whenever the incubator is being cleaned.
2. Ensure the white porous sensor cover is in place.
3. Connect the incubator to a grounded power supply using the power cord provided.
4. Switch the incubator ON using the on/off switch. The display will illuminate.
5. Ensure the regulator on the CO₂ supply is set to 5 psi or 0.35 bar, and turn on the supply.



NOTE:

If the power receptacle has a switch, ensure it is switched on. When the incubator powers up, the decimal points on the display for Temperature and CO₂ flash on and off to indicate the Alarm System is not yet armed.

6. The chamber set-points are pre-programmed at 37.0°C and 5% CO₂. Leave the incubator on until programmed chamber temperature, CO₂ (and O₂ if fitted) concentrations have been reached.



NOTE:

The CO₂ valve is inhibited until the incubator reaches temperature setpoint. The CO₂ valve will then activate, allowing CO₂ to reach programmed setpoint.

If power is interrupted long enough for the temperature to drop below setpoint, the CO₂ valve will be deactivated until setpoint is again achieved. (*This serves to avoid spurious CO₂ readings while the incubator is reaching temperature setpoint*)

7. Leave the incubator running for at least two hours (preferably overnight) to allow conditions to stabilise.

2.3 Using the Humidity Tray

If chamber humidification is required, the humidity tray should be filled with no more than 2000ml of tepid distilled water.



NOTE:

The humidity tray should always be in place, even if the incubator is not being humidified.

For general cell culture work, we recommend the use of copper sulphate (or other recognised commercial biocide) in the humidity tray. Tests demonstrated that in addition to inhibiting bacterial growth in the tray, this can reduce contamination on the chamber walls. Dissolve one small teaspoonful (~0.5g) of copper sulphate in the water in the humidity tray.

For IVF and other sensitive work, we do **not** recommend the use of **any** biocide in the humidity tray. To reduce the possibility of contamination, every 10 to 14 days, empty the tray, and clean it with a solution of 70% isopropyl alcohol / 30% distilled water. When dry, refill with warm distilled water.

 **NOTE:**

If you have any doubts regarding compatibility of decontamination or cleaning agents with any part of the incubator – seek advice from GS Biotech, or your local distributor.

 **CAUTION!**

Never leave water in the humidity tray if the incubator is switched off to avoid damage to CO₂ and O₂ sensors (if fitted).

The humidity level within the chamber is not adjustable. The internal chamber will naturally reach ~95% relative humidity at 37°C

2.4 Programming

2.4.1 Temperature and CO₂ Level

To set the desired operating temperature and CO₂ level:

1. Press the **PROG** function key (see Figure 9, left-most menu button):
2. In the **PROG** screen, press the desired function key, **TEMP** or **CO₂**, then use the ◀&▶ direction keys to adjust the value.

 **NOTE:**

If the incubator has O₂ control, set point can be selected or changed in the same way as temperature and CO₂ set points.

3. When the desired set point is displayed, press the **ENTER** key.
4. If any adjustments were made, allow the new set points time to stabilise.

 **NOTE:**

If a temperature >1°C below actual chamber temperature is set, the independent over-temperature system will activate. This will be indicated by a warning message on the display. When the chamber cools down, normal operation will resume. Programming a higher temperature can also deactivate the warning.

2.4.2 User Access Code

A programmable user access code can be set if required. The user access code restricts access to **PROG**, **USER**, and **ALARM** screens (where settings could be changed) to authorised persons only.

To set a User Access Code:

1. In the **PROG** screen (accessed by pressing **PROG** function key), the user access code will be displayed as four asterisks****.
2. Use the ◀&▶ direction keys to move to each digit, the ▲&▼ direction keys will then select a number from 0 to 9.
3. Once code has been selected, press the **ENTER** key to store it.
4. Programming access will now require the code to make any further changes.

To cancel an access code:

1. From the **PROG** screen, enter the current access code.
2. Program **0000** as the new access code.
3. Press **ENTER** key to save the change.
4. The code has been cancelled and programming is no longer restricted.

 **NOTE:**

If the access code has been misplaced, you will be *unable* to make changes to your incubator's settings. Contact your distributor or GS Biotech Ltd for instructions to access your incubator.

2.5 Referencing the CO₂ Sensor with Autoreference

Prior to first using the incubator, carry out a manual CO₂ Autoreference (see Section 2.6.2 for an explanation of this feature):

1. Perform a CO₂Autoreference by pressing the **USER** function key (see *Figure 9*), selecting the **PROGRAMMABLE CO2 AUTOREFERENCE**, and press the **START** key.
2. The unit will countdown as the Autoreference is running.
3. When the countdown is complete, the unit is ready to use.

 **NOTE:**

It may be necessary to open the door momentarily if, after performing an Autoreference, the CO₂ level is too high.

2.6 USER Settings

In the **USER** screen (see *Figure 11 below*), you can adjust the features called out on the screen.

Figure 11: USER SETTINGS Screen



This section explains each of the **USER** screen features. There are other **USER** options that may be displayed on this screen if they have been installed.

2.6.1 SET DATE AND TIME

The date and time is factory-set and will only require adjustment if you are in a different time zone, or when clocks change to Daylight Saving Time and back again to Standard Time. You may also select the style of display for the date.

A battery back-up system ensures the correct time/date is never lost.

2.6.2 PROGRAMMABLE CO₂ AUTOREFERENCE

When you select this feature, the **PROGRAM CO₂ AUTOREFERENCE** screen (see *Figure 12 below*) allows you to program the Autoreference frequency and time, or to run the Autoreference function manually.

The Autoreference System automatically re-references the CO₂ Sensor to atmospheric CO₂ in the following way:

1. A pump activates for two minutes, pumping HEPA-filtered atmosphere into the sensor's measuring chamber at a flow rate of 0.3 litres/minute. This displaces the chamber atmosphere from the sensor.

Figure 12: PROGRAM CO₂ AUTOREFERENCE Screen



NOTE:

This procedure does NOT affect the chamber environment.

2. At the end of the countdown, the control system adjusts the Autoreference Factor to reference the sensor to atmospheric levels of 0.05% CO₂.
3. The pump switches off, and the chamber atmosphere diffuses back into the sensor's measuring chamber. This takes three minutes, after which the normal CO₂ control system resumes.
4. The result of the Autoreference (listed as **A/Z** on some screens) is sent to the **DATALOGGER ALARM EVENTS** screen so that a record of the results will be kept.

The frequency of Autoreferencing can be set in steps, from once a day to once every 28 days, which is the default setting. If not required, it can be disabled (see *Section 2.6.4*).

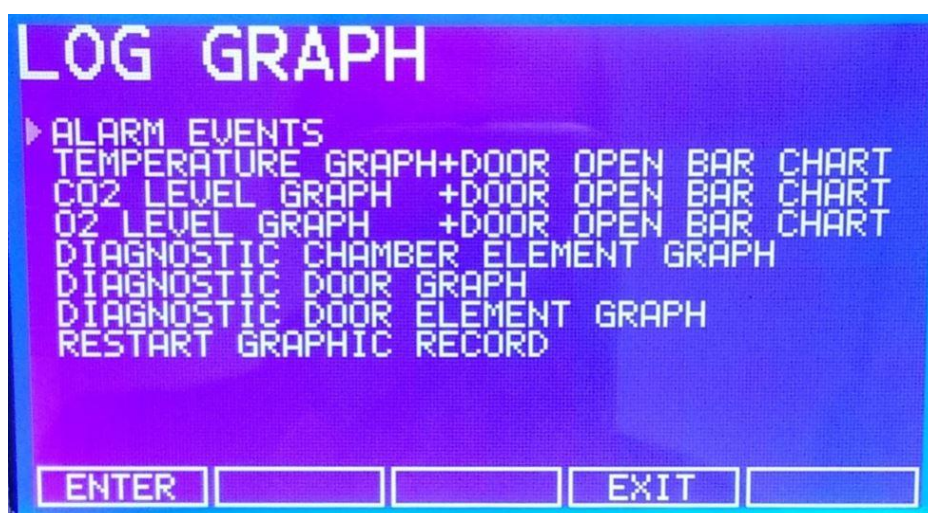
The default time setting is 7:00 am. This can be altered to suit your requirements. We recommend you only change the time setting shortly before you start to use the incubator.

 **NOTE:**

The Autoreference will only occur if the temperature is at set point. If the temperature is not at set point, the system will postpone Autoreference until the set point is reached.

If the Autoreference function is to be run manually, press the **START** function key, within the **PROGRAM CO₂AUTOREFERENCE** window.

2.6.3 LOG GRAPH



See Section **Error! Reference source not found.** for detailed information.

2.6.4 DISABLEALARM



This feature allows you to program the control system to ignore certain sensors if their function is not required. Additional Disable Options appear according to the options installed in the incubator. See *Section Error! Reference source not found.* for available options.

To disable a feature, scroll to **OFF** using the ◀&▶ direction keys, then press the **ENTER** key.

3 ROUTINE MAINTENANCE

3.1 General Notes

To ensure chamber conditions remain as stable as possible, minimise the length of time the door is open. The magnetic door catches are specifically designed to make door opening and closing as easy as possible. When opening the door, wipe off any small drops of condensate that may have formed on the inner seal. This will help avoid a build-up of condensation.

If you are using the humidity tray for humidification, be sure to follow the indications provided *in Section 2.3*.

3.2 Daily Checks

1. Check temperature and CO₂ levels are reading within specification.
2. Check the reserve pressure in the CO₂ cylinder (normally 725psi or 50bar when full). The incubator design ensures very low CO₂ consumption- during normal working conditions, a typical large cylinder should last approximately 12 months (frequent door openings will deplete the supply more rapidly). If there is a significant drop at the cylinder pressure below 725 psi or 50bar, it means that the cylinder is almost empty and should be replaced. Ensuring there are no leaks at any of the connections will ensure a greater use of the CO₂ supply, and help prevent running out of gas.

3.3 Weekly Checks

Refill the humidity tray. The use of warm water (~ 37.0°C) will ensure a rapid return to optimum chamber conditions.

3.4 Monthly Check

Routine replacement of the humidity tray water is recommended, and the tray should be cleaned at the same time.

1. If required, you can take a sample of the gas inside the chamber using the CO₂ sample port, and cross check it against a CO₂ gas analyser.

When conducting a sampling, please ensure the following:

- Turn off the CO₂ by re-programming the set point to 0.0% to prevent CO₂ from being injected into the chamber and giving a false reading.
- A flow rate ≤ 0.5 litres/minute is used to take a sample.
- The door is kept closed to minimise heat loss.
- Remember to reset the CO₂ set point to the original programmed level after sampling.

We recommend that a CO₂ Autoreference is carried out prior to sampling (see *Section 3.5*).

2. We also recommend that an Autoreference be carried out at least once every 28 days to ensure that CO₂ level is correct.

4 SERVICE

4.1 Fuse Replacement

To replace a fuse, you will need a flat-bladed (5mm maximum) screwdriver.

1. Using the flat-bladed screwdriver, rotate the fuse holder anticlockwise until the fuse holder springs out.
2. Remove the blown fuse.
3. Install a new fuse, of the same type and rating (20mm, 8A, Type 'F').
4. Orientate the fuse holder, and use the screwdriver to secure it in place.

5 CLEANING & DISINFECTING

5.1 Cleaning

1. Routinely clean the exterior of the incubator by wiping it over with a soft cloth, moistened with soapy water.
2. Rinse the soap from the cloth in clean water, and wipe the exterior surfaces again.

5.2 Disinfecting

The recommended disinfecting agent is a solution of 70% isopropanol (isopropyl alcohol) and 30% distilled water. Be sure to follow all local SOP's and procedures when using this solution:



WARNING!

- **Wear protective gloves and eye goggles as a minimum PPE.**
- **Adequately ventilate the area to avoid the formation of potentially explosive alcohol vapour.**
- **Protect all electrical connections from contact with the alcohol solution.**

To protect yourself, equipment and your work area, follow these instructions:

1. Program 0.0% CO₂ and switch off the incubator. Unplug the unit from the power supply.
2. Dampen a clean cloth with the alcohol solution and wipe down all external surfaces, taking care to prevent the alcohol solution from coming into contact with any electrical outlets or assemblies.
3. Remove all shelves, humidity tray and shelf racks.
4. Place the black protective cover(s) over the CO₂ sensor (and O₂sensor if fitted).

 **CAUTION!**

It is very important to ensure that no liquid is spilled onto the white porous CO₂ sensor cover at the rear of the chamber. Failure to use the protective cover(s) could result in damage to the sensor(s) and may affect your warranty.

5. You can clean the humidity tray by rinsing it in sterile water, wiping it down with alcohol/water solution, and then rinsing again with sterile water.
6. Wipe down the inside of the chamber with the alcohol/water solution, and leave it to dry completely.

 **CAUTION!**

Never use any of the following substances to clean the stainless steel, or damage will result: Sodium Azide, Aqua Regia, Iodine, Ferric Chloride or Sulphuric Acid.

7. Wipe the internal components of the chamber twice with the alcohol/water solution. Wipe off any excess liquid, and leave it to dry completely.
8. Reassemble the shelf racks, shelves and humidity tray before switching the incubator on. Wipe the inner door seal with the alcohol solution, rinse and leave to dry.
9. Ensure the protective cover(s) are removed from the sensor(s) and kept for safekeeping (protective covers must also be removed from any additional sensors installed, such as Oxygen or Humidity).
10. Refill the humidity tray (*as explained in Section 2.3*). When you reinstall it, ensure that the humidity tray is pushed fully back.
11. Leave the incubator on for at least two hours (preferably overnight) to allow conditions to stabilise.
12. When the incubator has stabilised, carry out an Autoreference and reprogram the desired CO₂ level. It may be necessary to open the glass door briefly if, after performing an Autoreference, the CO₂ level is too high.

6 SPECIFICATIONS

Incubator Specifications	
Temperature Management (see important NOTE on following page)	<ul style="list-style-type: none"> ▪ Digital programming via microprocessor control in 0.1°C increments. Measurement of chamber and door temperature via 6 RT* matched thermistors (sensitivity 0.01°C) ▪ Adjustable independent control of door heater ▪ "Out of Limits" temperature protection system independent of microprocessor control.
Range	4°C above ambient temperature to 50°C
Control	± 0.1°C
Stability	± 0.1°C at 37°C
Uniformity	≤± 0.3°C at ambient 20 - 25°C
Recovery Rate	Please refer to recovery graph
Note	If ambient temperature is close to the programmed value, control settings may need adjustment. Please consult GS Biotech for instructions.
CO₂ Control	Solid-state infrared CO ₂ sensor operating independent of humidity. Programmable, fully automatic zeroing function.
Range:	0.2 - 20%
Control:	± 0.1%
Stability:	± 0.2% at 5% CO ₂
Uniformity:	± 0.1%
Recovery Rate:	Better than 0.7% minute
Gas Connections:	6mm tubing
Required Gas Pressure:	5 psi / 0.35 bar
Relative Humidity	Removable stainless steel humidity tray
Reservoir Capacity:	2.5 litres
Humidity Control:	Normal: 95% at 37°C
Shelves	Polished stainless steel, non-perforated (standard).
Dimensions (WxD)	518 X 475
Number of Shelves:	4
Alarm Systems	Two-level alarm system giving programmable audio/visual warnings with options for remote communication. Level 1 signals system failures, level 2 is programmable and monitors chamber conditions.
Dimensions	
Chamber (HxWxD):	633 x 540 X 480
Chamber Volume:	170 litres
External (HxWxD):	822 x 669 X 631

*RT = Resistance Temperature curve

...continued...

Incubator Specification		
Weight	Uncrated: 75kg, with standard features	
A Grounded Electrical Supply is Required		
Voltage & Power:	Voltage	Power
	220V – 240V 50Hz	500 W / 1000w (High Temp)
Energy to maintain 37°C:	< 0.1 kWh	
Storage Temp / Humidity	10 - 50°C <80% Rh (non-condensing)	
Fuses	Standard Models	
Transformer Fuse	312mA, type 'F', 20mm	
Mains Fuse	8A, type 'F', 20mm	

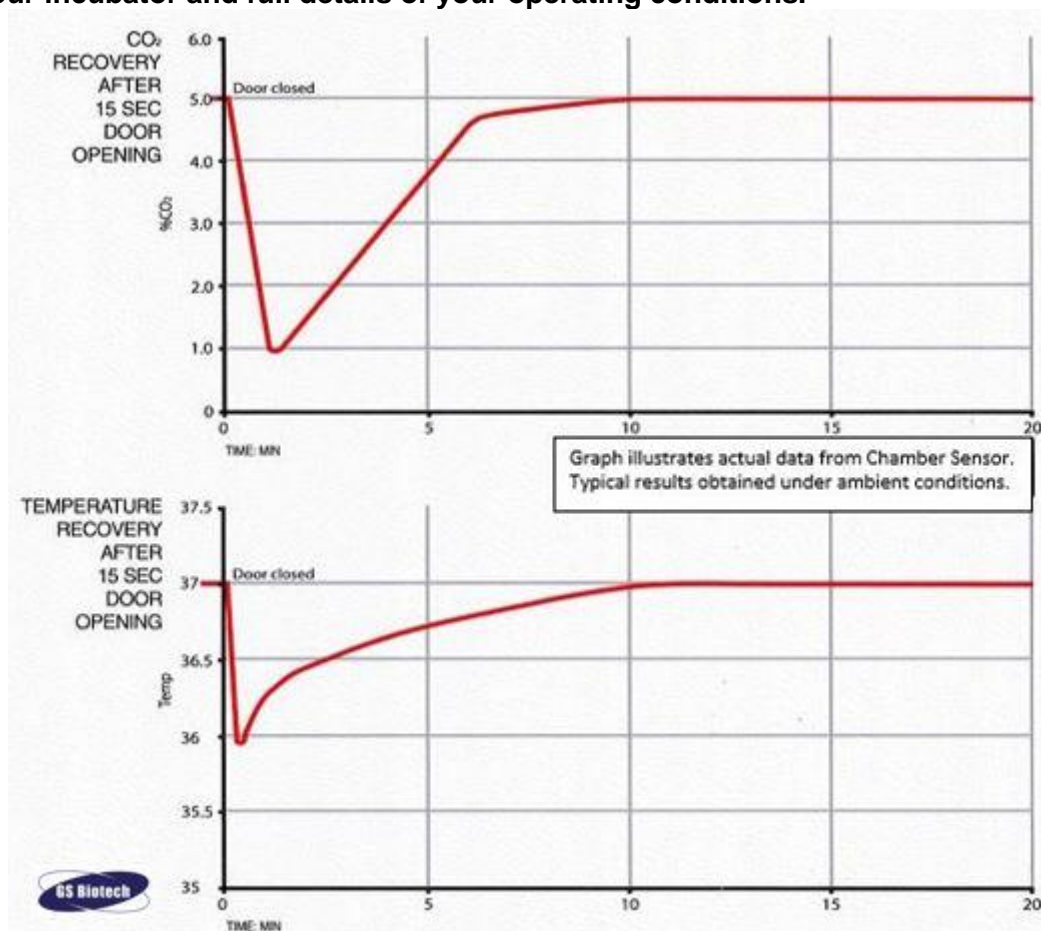
 **NOTE:**

Maximum operating ambient temperature is 35°C.

Factory calibration of the incubator is carried out at 37°C, 5.0% CO₂ and 90 to 95% RH, in an ambient temperature of 20-25°C with no heat-generating apparatus inside the chamber.

Software calibration adjustments may be required to optimise performance if the incubator is being used well outside these operating conditions. Performance specifications may also be affected.

For advice on calibration adjustments and relevant performance specifications, contact GS Biotech. Please be prepared with the model and serial number of your incubator and full details of your operating conditions.



7 OPTIONS & ACCESSORIES

RS232 Interface Option

The RS232 interface port provides a connection for the incubator to a personal computer or terminal. This allows the incubator to be programmed remotely and the incubator's operating status to be viewed on a remote screen.

In addition to the incubator and this port, you will need the following:

- A PC or terminal, capable of RS232 communication, with one serial com port free for this connection.
- A null-modem screened cable of suitable length (see **NOTE** below). To ensure reliable communication, the cable should not exceed 49 feet/15 meters in length. One end must have a 9-pin female D connector (to connect to the incubator's RS232 port) and the other end must have either a 9-pin or 25-pin female D connector, whichever mates to your PC or terminal.
- Suitable communications software, such as HyperTerminal (included with Windows®). The incubator requires the following settings in the communications software:

Baud Rate	19200 bits/second
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	Hardware (some cables may require it to be "None")

NOTE:

The computer should be connected to a power supply outlet as close as possible to the incubator, to avoid grounding problems.

1. Connect the null-modem cable to the RS232 port at the rear of the incubator (see *Figure 10*).
2. Connect the other end of the cable to *either* the 25-pin male D serial com port *or* the 9-pin male D serial com port on the PC or terminal.
3. Turn on the computer and start the communications software.
4. Select an unused serial port to enable communications between the incubator and the PC or terminal. If you know which port to use, continue to Step 5 and then skip to Step 7. If not, continue to Steps 5 & 6.
5. Using the communications software, select the unused port (COM1, COM2, COM3, etc.) then press the ↵ **Enter** key on the

PC/terminal keyboard. If you have successfully chosen an unused port, the message **Type '?' for help** should appear on the computer screen.

6. If you see any other message, or nothing happens, select the next port and press the ↵ **Enter** key again. If you still do not see the expected message, change the Flow Control setting from **Hardware** to **None**, then try again.
7. When the connection between the incubator and PC/terminal has been successfully established, and the message indicated in Step 5 appears, type (as prompted by the message onscreen) a ? in the communications software, then press the ↵ **Enter** key.
8. The following menu should now appear on the computer screen:

```

?

[Galaxy R+ Incubator Command Help]
PTnn.n (P)rogram (T)emperature to nn.n degrees
PCnn.n (P)rogram (C)O2 to nn.n percent
PATHnn.n (P)rogram (A)larm (T)emperature (H)igh to nn.n degrees
PATLnn.n (P)rogram (A)larm (T)emperature (L)ow to nn.n degrees
PACHnn.n (P)rogram (A)larm (C)O2 (H)igh to nn.n percent
PACLnn.n (P)rogram (A)larm (C)O2 (L)ow to nn.n percent
LD (L)ist (D)atalogger
LDT (L)ist (D)atalogger (T)emperature alarms
LDC (L)ist (D)atalogger (C)O2 alarms
LDP (L)ist (D)atalogger (P)ower on/off events
S (S)tatus report
SInn.nn (S)tatus report at (I)nterval nn.nn (mins.secs)
U (U)ersion number report
? (?) Gives this help screen
  
```

This menu allows the incubator temperature, CO₂ and alarm setpoints to be programmed remotely. A running status report can be generated at user-defined intervals, and all reports can be sent to a printer. *For details on these features, consult the documentation supplied with your communications software.*

Remote Programming: all commands beginning with P can be used to program the incubator from the remote computer. These commands are not case sensitive: lower case or upper case letters work exactly the same way. The following are examples of how each of the above commands might be used:

PTnn.n	(P)rogram new (T)emperature setpoint. Type PT37.5 , then press ↵ Enter to reprogram the incubator's temperature setpoint to 37.5°C.
PCnn.n	(P)rogram new (C)O ₂ level. Type PC04.0 , then press ↵ Enter to

	reprogram the incubator's CO ₂ level to 4%.
PATHnn.n	(P)rogram new (A)larm (T)emperature (H)igh setpoint. Type PATH38.0 , then press ↵ Enter to reprogram the incubator's high temperature alarm setpoint to 38.0°C.
PATLnn.n	(P)rogram new (A)larm (T)emperature (L)ow setpoint. Type PATL36.0 , then press ↵ Enter to reprogram the incubator's low temperature alarm setpoint to 36.0°C.
PACHnn.n	(P)rogram new (A)larm (C)O ₂ level (H)igh setpoint. Type PACH05.5 , then press ↵ Enter to reprogram the incubator's high CO ₂ level alarm setpoint to 5.5%.
PACLnn.n	(P)rogram new (A)larm (C)O ₂ (L)ow setpoint. Type PACL04.5 , then press ↵ Enter to reprogram the incubator's low CO ₂ level alarm setpoint to 4.5%.

In each case, the change is confirmed by a message from the incubator (e.g., **Program Temperature 37.5°C OK**, or **Program Alarm Temperature High 38.0°C OK**, etc.).

Status Commands: all commands beginning with S can be used to interrogate the incubator from the remote computer, and to display the current status of the incubator. As with the program commands, these commands are not case sensitive: lower case or upper case letters work exactly the same way. The following are examples of how each of the Status commands might be used:

S	(S)tatus report. Type S , then press the ↵ Enter key to display a current status report, which may look like this: Temperature: Actual 37.0°C Setpoint 37.0°C CO₂: Actual 05.0% Setpoint 05.0%
Slnn.nn	(S)tatus report at (I)nterval of n minutes, n seconds. Type Sl60.0 , then press the ↵ Enter key to display a current status report (as shown above) every hour. A confirmation message will appear: Status report at interval 60.0 will be given Press "Enter" or "ESC" to stop reports

Other Commands: As with the Program and Status commands, the V (Version number report) and ? (Help) commands are not case sensitive. To use these two commands:

V	Type V , then press the ↵ Enter key to generate a report on the current firmware version.
?	Type ? , then press the ↵ Enter key to return to the initial help screen.

Alarm/Event Messages: a number of messages are preset to appear on the computer screen to inform you of either an alarm condition or a certain event. The following table recaps those messages:

Type of Message	Message
Alarm	TEMPERATURE LOW
Alarm	TEMPERATURE HIGH
Alarm	CO2 LOW
Alarm	CO2 HIGH
Alarm	TEMPERATURE SENSOR FAILURE
Alarm (Autoreference)	PROG CO2 A/R SYSTEM INOPERATIVE
Autoreference Event	PROG CO2 A/R COMPLETED OK
Door Event	DOOR OPENED
Door Event	DOOR CLOSED

After displaying any of the above messages, a status report message relative to the alarm or event will be displayed, e.g.:

[DOOR EVENT] DOOR OPENED
Temperature: Actual 37.0°C Setpoint 37.0°C
CO2: Actual 00.1% Setpoint 05.0%

