eppendorf

Galaxy® 48R CO_2 Incubators

Operating manual

The company reserves the right to change information in this document without notice. Updates to information in this document reflect our commitment to continuing product development and improvement.

6705 900.041-00/122015 Gen. 2

Table of contents

1 Operating instructions

1.1 Using this manual

- Read this operating manual completely before using the device for the first time. Also observe the instructions for use of the accessories.
- This operating manual is part of the product. Thus, it must always be easily accessible.
- Enclose this operating manual when transferring the device to third parties.
- You will find the current version of the operating manual for all available languages on our website, www.eppendorf.com.

1.2 Danger symbols and danger levels

The safety instructions of this operating manual indicate the following danger symbols and danger levels:

1.2.1 Danger symbols

	**Hazard point**		**Burns**
	**Electric shock**		**Material damage**
	**Explosion**		**Heavy loads**
	**Inhalation**		**Crush**

1.2.2 Danger levels

DANGER	*Will* lead to severe injuries or death.
WARNING	*May* lead to severe injuries or death.
CAUTION	May lead to light to moderate injuries.
NOTICE	May lead to material damage.

1.3 Symbols used

Example		Meaning
	▸	You are requested to perform an action.
	1. 2.	Perform these actions in the sequence described.
	•	List.
		References useful information.

2 Safety

2.1 Intended use

Eppendorf CO_2 Incubators are microprocessor-controlled instruments designed for cell culture. The direct-heated, fanless chambers are designed to provide high humidity levels, minimal vibration and precisely-regulated atmosphere of temperature and gas(ses) required for cell growth in T-flasks, microplates, and other cultureware. They are intended for indoor laboratory use only.

CAUTION! Lack of safety due to incorrect accessories or spare parts
Accessories and spare parts that are not recommended by Eppendorf compromise the safety, function and precision of the device. Eppendorf cannot be held liable or accept any liability for damage resulting from the use of non-recommended accessories and spare parts.

- Only use accessories and original spare parts recommended by Eppendorf.

WARNING! Lack of safety due to incorrect gas installation or wrong/minor ventilation

- Please observe the national standards and regulations for the use/handling of gas. Installation and connection of gas tubing should be done by educated personnel.

2.2 User profile

The device may only be operated by trained lab personnel who have carefully read the operating manual and are familiar with the device functions.

2.3 Application limits

2.3.1 Description of ATEX Guideline (94/9EC)

DANGER! Explosion hazard

- Do not operate the device in areas where work is completed with explosive substances.
- Do not use this device to process any explosive or highly reactive substances.
- Do not use this device to process any substances which could create an explosive atmosphere.

Due to its design and the ambient conditions in its interior, the device is not suitable for use in potentially explosive atmospheres.

The device may only be used in a safe environment, e.g., the open atmosphere of a ventilated lab or fume hood.

The use of substances which may contribute to a potentially explosive atmosphere is not permitted.

The final decision regarding the risks associated with using these types of substances is the user's responsibility.

2.4 Information on product liability

In the following cases, the designated protection of the device may be compromised.

The liability for the function of the device passes to the operator if:

- The device is not used in accordance with this operating manual.
- The device is used outside of the range of application described in the succeding chapters.
- The device is used with accessories or consumables that were not approved by Eppendorf.
- Service or maintenance is completed on the device by people who are not authorized by Eppendorf.
- The owner has made unauthorized modifications to the device.

2.5 Warnings for intended use

Before using the device, read the operating manual and observe the following general safety instructions.

2.5.1 Personal injury and damage to device

WARNING! Risk of personal injury

- Elevated levels of CO_2 may be found in and around the operating area of the CO_2 incubator.
- Wear personal protective equipment (PPE).
- Use a CO_2/O_2 alarm system for the Lab, if room is not properly ventilated.
- Check the tube connection system with a leakage test.

WARNING! Risk of personal injury
Burns due to hot surface.

- Do not touch the equipment during the high temperature disinfection cycle.
- Do not open equipment door during the cycle.

WARNING! Risk of personal injury

- Do not open the device.
- Do not operate a broken device. (e.g. if the exterior is damaged)
- Do not modify the device!

WARNING! Risk of personal injury and equipment damage
The incubator or incubators may topple if they are not fixed with a safety latch.

- Each incubator or stack of two incubators on a stacking stand must be fixed to the wall with a safety latch.

CAUTION! Risk of personal injury

- Safety standards of lab must be considered.
- Use your personal protective equipment.

CAUTION! Risk of personal injury

- More than one person is required to safely lift the incubator.
- The incubator has a high center of gravity. Make sure it does not topple over during transportation/moving!

CAUTION! Risk of personal injury

- Before closing the glass door be sure that the shelves are well installed inside the chamber. Slamming the glass door against the shelf could cause broken glass and potential injury.

NOTICE! Risk of material damage

- Never try to lift the incubator by its door; this would cause permanent damage to the incubator.

NOTICE! Risk of material damage

- Never put any liquid material on the top of the incubator. Spilled liquid could cause short circuit; this would cause permanent damage to the incubator.

NOTICE! Risk of material damage

- To avoid possible damage to the CO_2 sensor, never leave water in the humidity tray while the incubator is switched off, or when a high temperature disinfection cycle is initiated (optional feature).
- Allow a clearance of 15 – 20 cm (6 – 8 in) to allow access for oxygen sensor removal.
- For O_2 option: Remove the O_2 sensor.

NOTICE! Risk of material damage

- CO_2 gas pressure must not exceed 0.1 MPa (1.0 bar, 14.5 psi) at the CO2 inline pressure regulator.
- For O_2 option: N_2 gas pressure must not exceed 0.1 MPa (1 bar, 14.5 psi) at the inline pressure regulator.

NOTICE! Risk of material damage
Working with electrical power inside a humid environment (where the incubator is humidified) can cause damage. The following precautions should be observed:

- The instrument or equipment, and its external connections, to be used inside the chamber should be specified as suitable for use in a humid environment, and at 37 °C. If in doubt, consult with the manufacturer of the equipment.
- Always ensure the connections are properly and securely made.
- Instruments bring heat into the chamber. Do not bring too much heat into the chamber. Too much heat will cause trouble in the temperature control; this could cause a loss of sample.

NOTICE! Risk of material damage

- Do not modify the device; this could cause the loss of sample.

3 Product description

3.1 Product overview

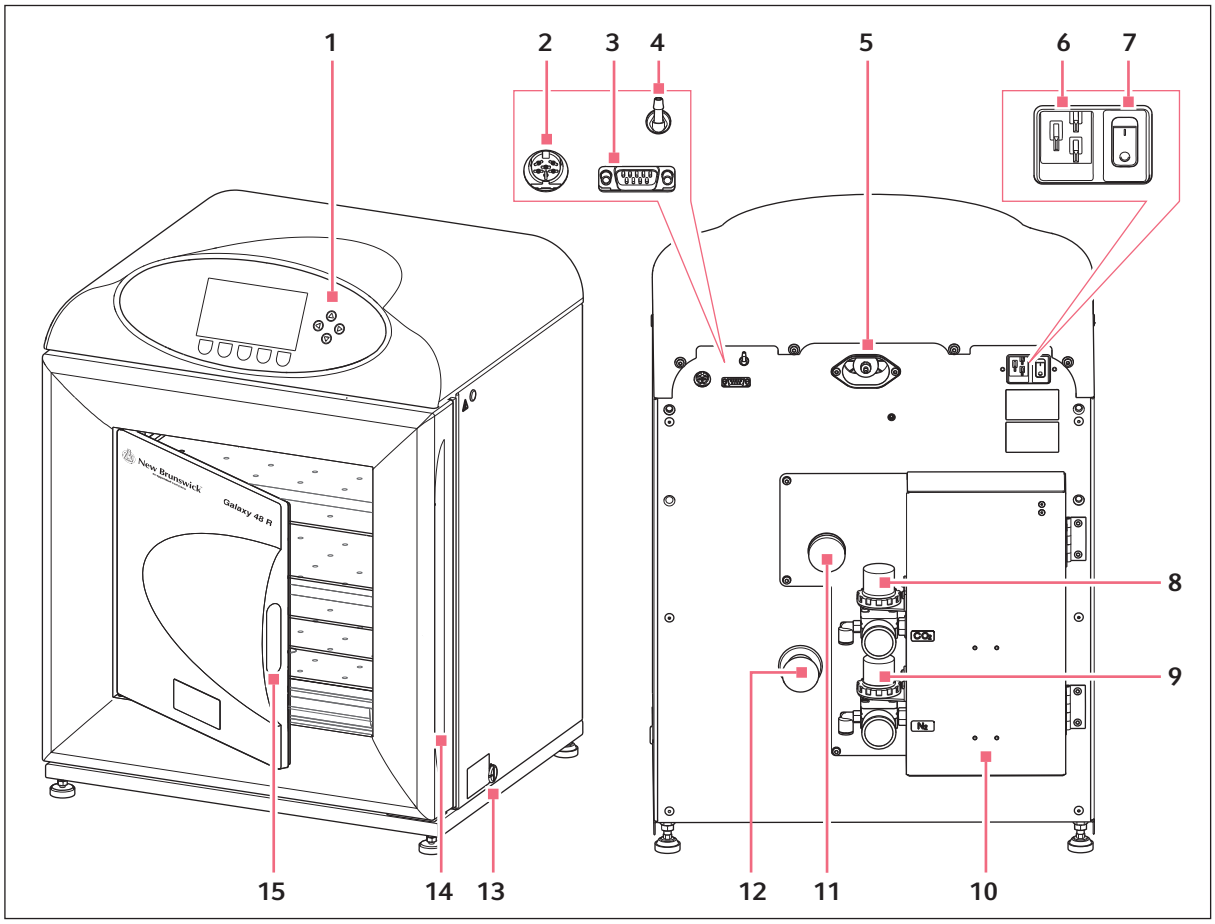


Fig. 3-1: Front and back view

1 Operating controls

2 BMS relay contact alarm socket

3 RS232 socket

4 CO_2 sample port

5 Autozero filter

6 Main/power cord receptacle

7 On/Off switch

8 Inline pressure regulator CO_2

9 N_2 inline pressure regulator (optional)

10 Gas box

11 O_2 sensor port (optional)

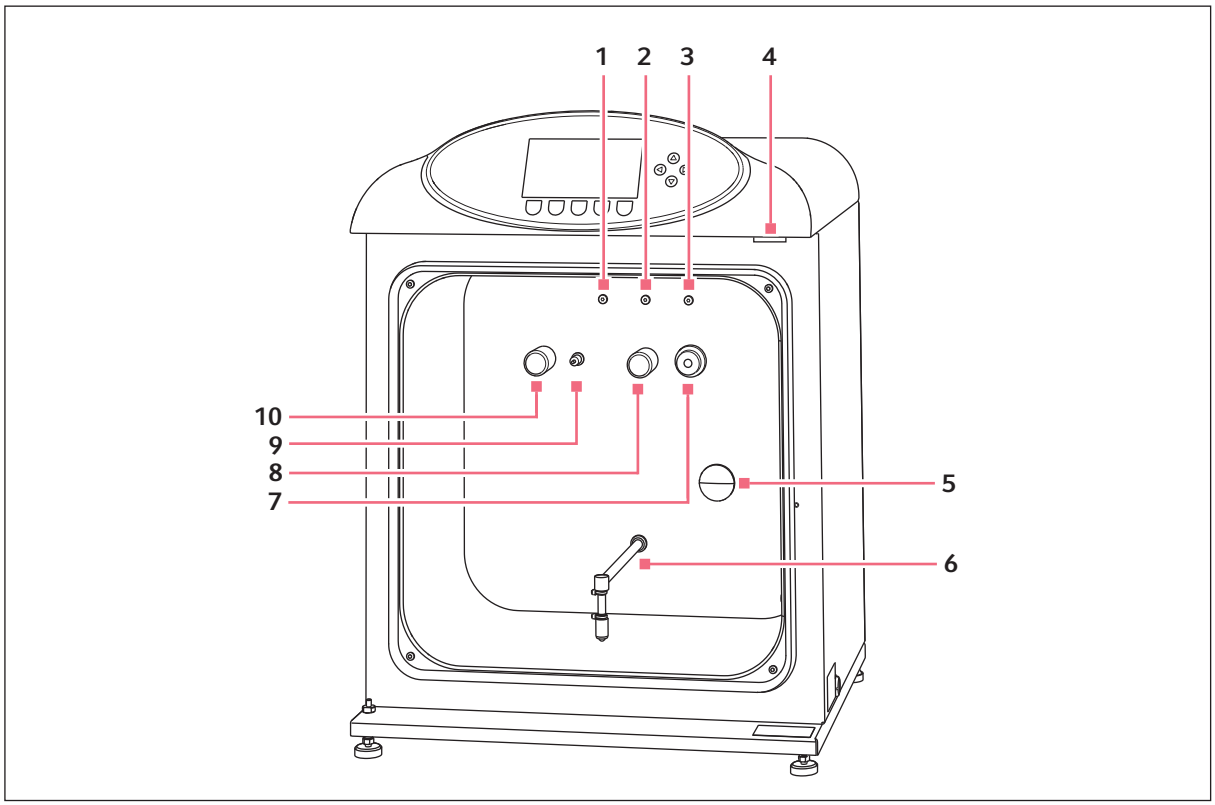
12 25 mm access port

13 Humidity control

14 Handle for outer door (with integrated heated viewing window)

15 Handle for opening of viewing window

3.1.1 Inside the chamber



1 **Sample port**
2 **N_2 inlet (option)**
3 **CO_2 inlet**
4 **Door switch**
5 **Access port**
6 **Water level sensor (option)**
7 **O_2 sensor (option)**
8 **CO_2 sensor**
9 **Temperature probe**
10 **Humidity sensor (option)**

3.2 Control panel

The control panel consists of an LCD display, 5 function keys and 4 direction keys.

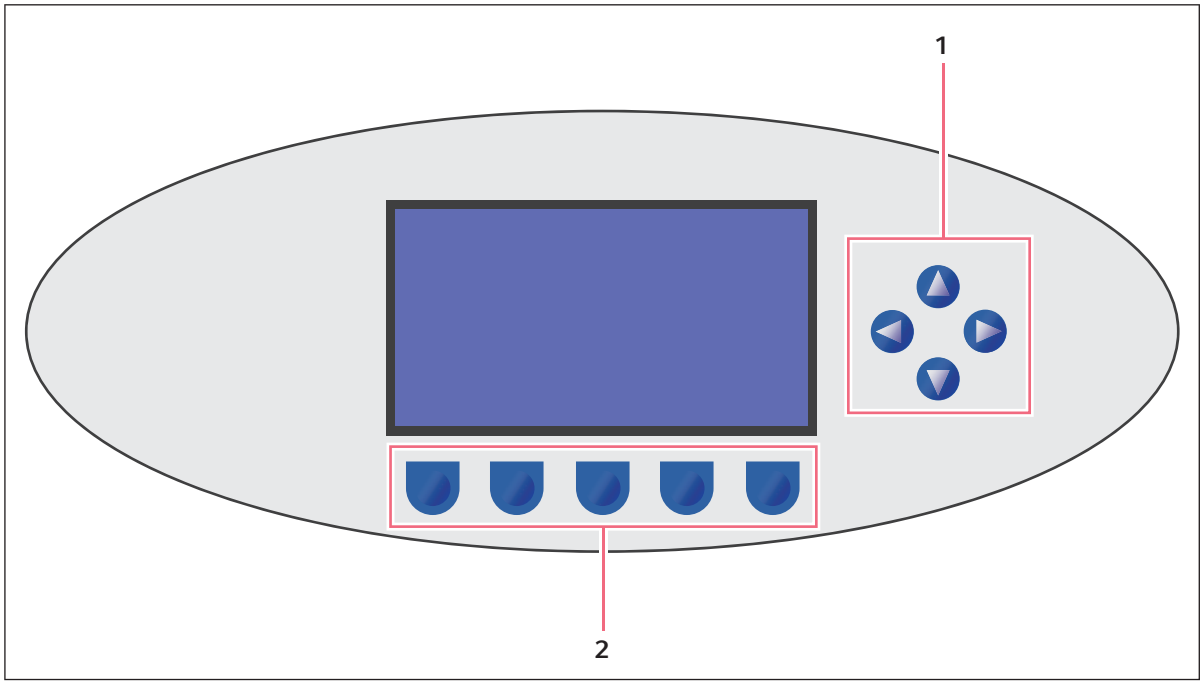


Fig. 3-2: Control panel

1 Directional keys
Move cursor around the screen
Adjust values

2 Function keys
Purpose of each key is identified at the bottom of the display (above the corresponding key)
Function may change from screen to screen

The *HELP* file contains most of the information in this operating manual, together with more detailed troubleshooting information (see *HELP MENU screen on p. 41)*.

3.3 Accessories provided

Tab. 3-1: Accessories

Quantity	Item	Notes
1	User manual	Provided
3	Non-tip perforated shelves	Installed
2	Wired shelf racks	Installed
1	Humidity tray	Installed
16+4	Silicone rubber suction feet	Installed Additional 4 spares packed in accessories bag
1—2+2	White porous CO_2 sensor cover	Installed (depending on options) Additional 2 spares packed in accessories bag
1—2	Black sensor cover	Installed (depending on options)
1	Power cord	Packed in box inside outer carton
1—2	10 mm (0.4 in) outer diameter tubing with 6.5 mm (0.2 in) inner diameter with large white filter	Packed in accessories bag (depending on options)
4	Tubing clips	2 installed Additional 2 packed in accessories bag
1	Autozero HEPA filter	Installed
4	Adjustable feet	Installed
4	Anti-slip pads for adjustable feet	Packed in accessories bag
1	BMS standard 6-pin DIN plug	Packed in accessories bag
1	Safety fastening kit	Packed in accessories bag
2	Plug for access port	Installed
1	Plug for O_2 sensor	Installed (depending on options)
2	Plugs for threads for stacking stand assembly	Installed
1	Jaw wrench for adjusting the feet	Packed in accessories bag

3.3.1 Inspection of boxes

Inspect the boxes carefully for any damage that may have occurred during shipping. Report any damage to the carrier and to your local Eppendorf sales order department immediately.

3.3.2 Packing list verification

Unpack your order, saving the packing materials for possible future use. Save the operating manual for instruction and reference. Verify against your Eppendorf packing list that you have received the correct order.

3.4 Features

The Galaxy 48 R CO_2 incubator is microprocessor-controlled and designed to ensure accurate and reliable operation.

3.4.1 Operating controls

The incubator incorporates a sophisticated control system that allows for easy programming, control and monitoring of the chamber conditions.

3.4.2 Direct heating system

The direct heating system, utilizing a thermal heating element, completely surrounds the incubator, providing an even temperature within the chamber. The independently and directly heated outer door is designed to ensure an even distribution of heat. This system ensures a rapid, controlled return to optimum chamber conditions after an outer door opening while also preventing any overshoot. The incubator's direct heat system provides for optimal use of laboratory space by allowing the most efficient internal volume for the footprint of the instrument.

3.4.3 Infrared sensor

A solid-state infrared sensor controls the level of CO_2. It provides excellent reliability while remaining unaffected by humidity. The CO_2 system has a semi automatic zero system (Autozero) to re-reference the sensor baseline to atmospheric CO_2 levels at regular intervals. This provides accurate CO_2 control.

3.4.4 Humidity tray

A water tray at the bottom of the incubator creates a high, uniform relative humidity (RH) while preventing condensation in other parts of the chamber. Perforated shelves are provided as standard to facilitate recovery of RH conditions in the chamber.

3.4.5 Seamless chamber

The 48 liter chamber is seamless, and provides a sanitary and easy-to-clean environment All internal components are manufactured from polished stainless steel. The non-tip shelves, shelf racks and humidity tray are easily removed without tools for thorough cleaning and are able to be sterilized. Air circulation is achieved without the use of a fan, which eliminates ductwork (a potential source of contamination), simplifies cleaning, eliminates vibration, and facilitates use of microplates and low-volume culture.

3.4.6 Standard features

The Galaxy 48 R contains many standard features usually seen as options. It has a sealed glass door with a covert window to allow viewing of the cultures without compromising the internal atmosphere. Also is available a 2-split-door option (to coordinate with shelves), which is ideal for critical hypoxic studies. In addition, there is a 25 mm (1 in) access port to allow for seamless integration of independent probes or other equipment through the chamber. Building management system (BMS) relay is standard on every incubator and allows alarms to be transmitted to a central monitoring system. All units are also equipped with an RS-232 port that allows instrument to be connected to a PC for the recording of operating parameters.

3.4.7 Multiple options

The incubator features multiple options that can be installed to simplify maintenance and provide superior control over experimental conditions.

For example, high-temperature disinfection quickly and conveniently disinfects the incubator's chamber at 120 °C, without the need to remove interior components or the CO_2 sensor (except the optional O_2-sensor).

A humidity tray warning system warns the user before the humidity tray runs out of water, preventing dehydration of samples. The humidity tray must be emptied and the device must be clean and dry prior to running high-temperature decontamination.

Oxygen control provides for conditions that require below-ambient oxygen levels. For a complete list of the available options, (see *Available options on p. 77)*.

3.4.8 Two-level alarm system

The incubator incorporates a two-level alarm system. The system alarms occur only if a problem develops 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.

3.5 Stacking devices

The incubator is not designed to be directly stackable. A second incubator may be safely stacked on top of another identical incubator by using the custom-designed stacking stand available as an accessory . It is not possible to put any other type of incubator or heavy apparatus on top, as the top cover and stacking stand were not designed to support any other device.

4 Installation

4.1 Utilities requirements

The following utility requirements are needed to operate the incubator:

Tab. 4-1: Utility requirements

Utility	Requirement
Electricity	110 V – 120 V, 50/60 Hz earth/grounded mains/electrical supply with minimum capacity of 10 amps.
	220 V – 240 V, 50/60 Hz earth/grounded mains/electrical supply with minimum capacity of 8 amps.
Mechanical	Safety Fastening Kit for fixing one incubator or two stacked incubators to the wall.
CO_2 gas	Cylinder with 100 % CO_2 vapor withdrawal, together with a two-stage regulator for pressure control to 18.85 psi (1.3 bar).
For O_2 option: N_2 gas	Cylinder with 100 % N_2 vapor withdrawal, together with a two-stage regulator for pressure control to 21.7 psi (1.5 bar).

- CO_2 gas pressure at the inline pressure regulator must not exceed 0.05 MPa (0.5 bar, 7.2 psi).
- Only in case of using the low O_2 option it is necessary to use a higher CO_2 pressure at the inline pressure regulator: At 0.1 % O_2 setting use 0.1 MPa (1.0 bar, 14.5 psi) CO_2.
- N_2 gas pressure at the inline pressure regulator must not exceed 0.1 MPa (1 bar, 14.5 psi).

4.2 Selecting the location

Select a level surface capable of withstanding the operating weight of the incubator. Actual operating weight will be dependent on both the options installed, and the material stored in the incubator.

The incubator is designed to operate at a chamber temperature of 4.0 °C above ambient, and at an absolute minimum ambient temperature of 15 °C. **Maximum allowable ambient temperature is 28 °C.**

Position incubator to allow clearance for opening door and access to the power cord/power switch and to the CO_2 sample port located on the rear side of the incubator.

Place the incubator in a well ventilated space. Avoid placing the incubator in areas that may affect 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 drafts
- Directly beside heat-generating equipment such as a heater, an autoclave or an oven
- Near the exhaust of heat or cold-generating equipment
- Near a window exposed to direct sunlight
- Directly on top of any heat-generating apparatus.
- Without minimum ventilation clearance of 10 mm (0.5 in) all around.

4.3 Initial setup

4.3.1 Installing the feet

CAUTION! Risk of personal injury

- More than one person is required to safely lift the incubator.

To ensure adequate airflow for correct operation of the relative humidity control system, the incubator feet must be installed.

To install the adjustable feet:

1. If they are not already installed, install the locking nuts onto each of the 4 feet provided.
2. Tilt the incubator back and screw the front 2 feet in to the required depth.
3. Tilt the incubator forward to install the rear pair of feet.
4. Place an anti-slip pad (provided) on each foot.

Keep anti-slip pads installed at all times.

4.3.2 Install the power cord

To install the power cord:

1. Insert the power cord into its receptacle on the back on the incubator.
2. Press the cord firmly into its socket.

4.3.3 Making connections

WARNING!

- Please observe the national standards and regulations for the use/handling of gas.
- Installation and connection of gas tubing should be done by educated personnel.

WARNING! Risk of personal injury

- Elevated levels of CO_2 may be found in and around the operating area of the CO_2 incubator.
- Wear personal protective equipment (PPE).
- Use a CO_2/O_2 alarm system for the Lab, if room is not properly ventilated.
- Check the tube connection system with a leakage test.

WARNING! Risk of personal injury

- Do not forget to remove the sensor protective covers when putting the device into routine work. If they rest and cover the sensor, e.g. CO_2 will continuously flow into the incubator and possibly leak out of the device.

WARNING! Danger due to incorrect power supply

- Only connect the device to voltage sources that meet the requirements on the name plate.
- Only use sockets with a protective earth (PE) conductor and suitable power cable.

1. Remove sensor (CO_2, O_2, and RH) protective cover (option dependent), and store for future use.
2. Attach the supplied 6.5 bore tubing with large white filter to the two-stage pressure regulator outlet. Secure the connected end with a clip.
3. Attach supplied 6.5 mm bore tubing with large white filter to the gas inline pressure regulator. Push the tubing into the rotatable tube connector of the inline regulator approximately 8 mm until it stops.

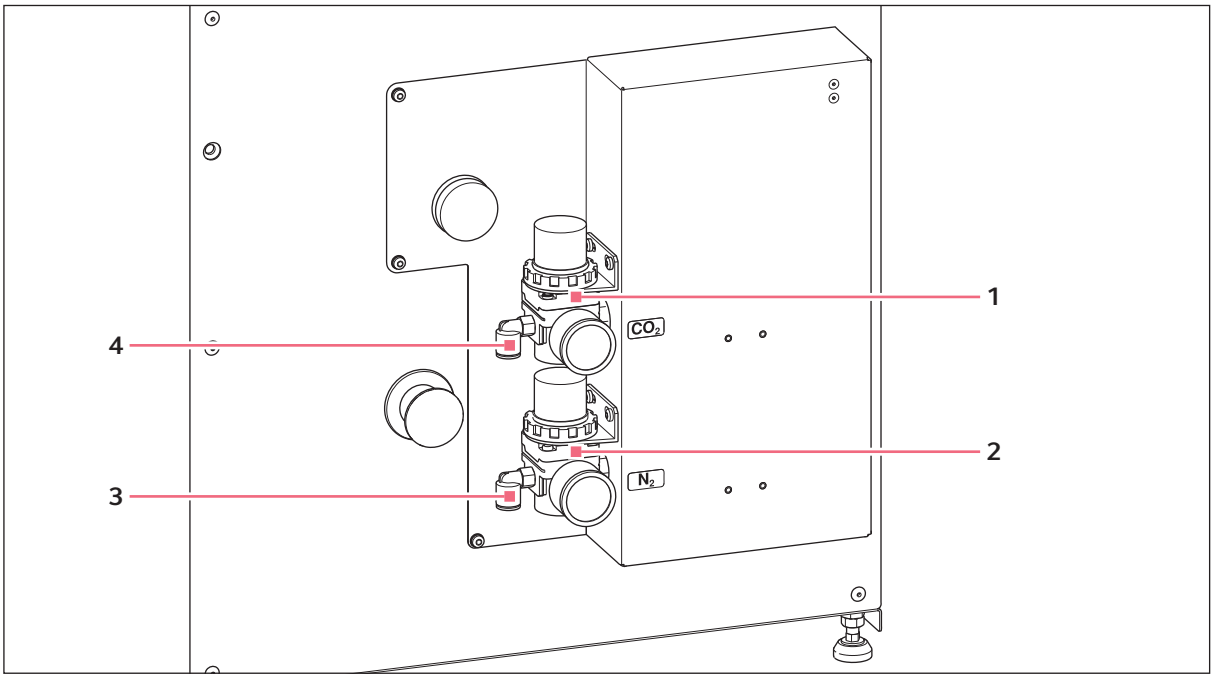


Fig. 4-1: Pressure regulator outlet

1 In-line pressure regulator CO_2
2 In-line pressure regulator N_2
3 Tube connector N_2
4 Tube connector CO_2

The inline pressure regulator controls Secondary Gas Pressure. A default pressure setting for CO_2 of 0.05 MP a (0.5 bar, 7.2 psi) is recommended. O_2 option: A default pressure setting for N_2 of 0.1 MPa (1.0 bar, 14.5 psi) is recommended. Adjust the regulator knob to the required outlet pressure and purge tubing, making the final adjustments when the gas is flowing. A large size cylinder of "CO_2 - Vapor Withdrawal" is required to supply the incubator. This cylinder controls Primary Gas Pressure. Fitting a Two-Stage CO_2 Pressure Regulator is recommended.

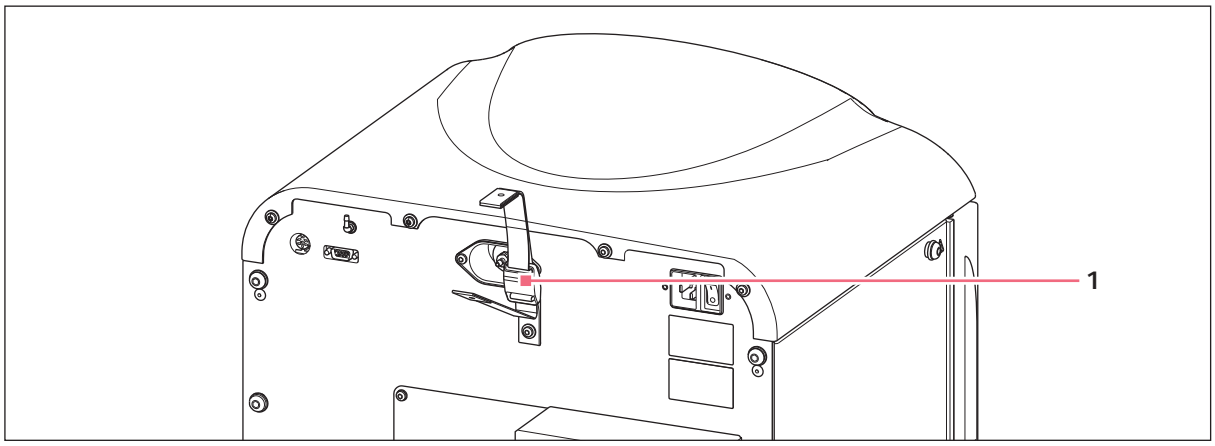
Ensure the protective cover(s) are removed from all sensor(s). Be very careful as you remove the black CO2 sensor cover, not to accidentally remove the white porous sensor cover. This must remain in place.

4. Test that the tubing is fixed by lightly pulling on it. It should not move.

   For disconnecting the tubing press down the small ring of the tube connector and pull out the tubing.

5. Control the pressure settings of the CO_2 inline pressure regulator and (if connected) the N_2 inline pressure regulator. Note that the pressure unit is shown in MPa at the inline pressure regulator.
6. Confirm the voltage requirements with the label information.
7. Using mains/power cord supplied, connect incubator to correct mains/voltage supply.

8. Secure the incubator to the wall with a safety latch. Please follow the instruction for the Safety Fastening Kit. Please note: Use the mounting point close to the position of the auto-zero filter.



1 Safety latch

4.3.4 Replacing the shelf racks and shelves, and level the incubator

The shelf racks and shelves are pre-installed. If replacement is required:

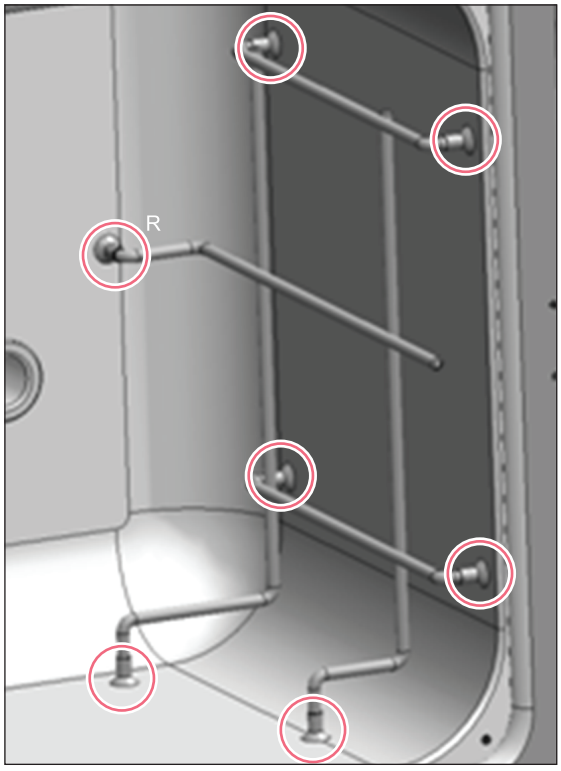


Fig. 4-2: Wire shelf rack

1. Each wire shelf rack has silicone suction cups that hold the rack in place. Install the silicone suction cups onto the wire rack supports (7 per rack, circled in figure).
2. Note that there are left-hand and right-hand racks. The suction cup marked *R* in the figure goes to the rear of the chamber.
   The suction cups will adhere to the chamber walls even if they are dry. However, if you feel it is necessary, you can dampen them with distilled water to increase adhesion.

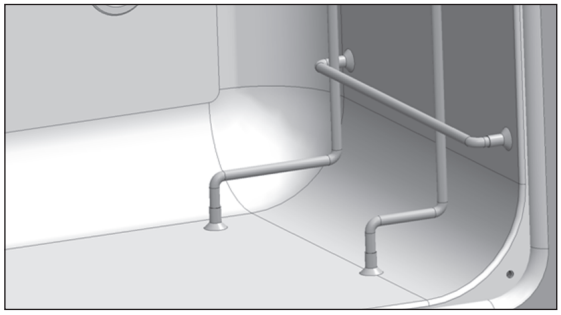


Fig. 4-3: Suction cup

3. Ensure the shelf racks are installed squarely in the chamber so the shelves will sit on a level plane.

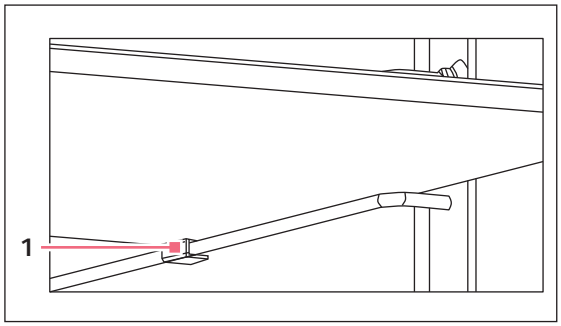


Fig. 4-4: Shelf rack

4. Install the 3 shelves, making sure that each shelf's anti-tip tab is properly inserted onto each of the wire shelf rack guides.
5. Level the incubator by adjusting the feet: place a small level on the second shelf of the incubator and adjust the leveling feet until the incubator is level and stable. Lock the leveling legs in place by tightening the locking nuts on each leg.

4.3.5 Replacing the humidity tray

The humidity tray is pre-installed. If replacement is required, install the humidity tray in its location beneath the lowest shelf rack position:

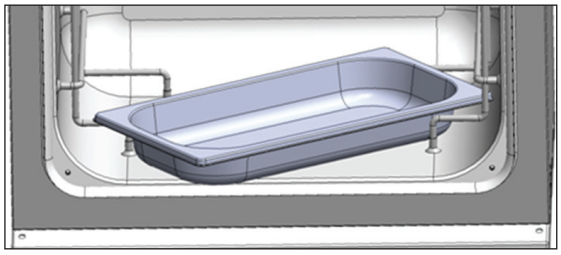


Fig. 4-5: Humidity tray

1. Insert the tray diagonally as shown, then turn the tray 45° until you can set it in position.

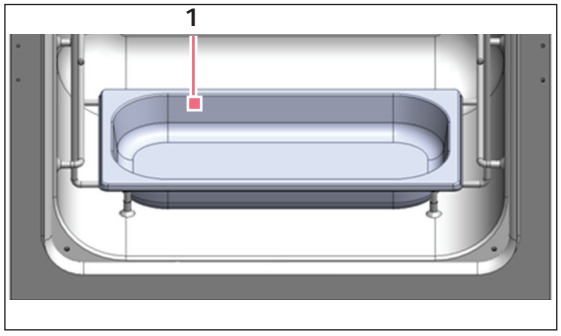


Fig. 4-6: Humidity tray

2. Position the tray to rest on the chamber floor, with its front and rear edges resting just above the shelf rack supports.

4.3.6 Replacing the autozero filter

The autozero filter is pre-installed. If replacement is required:

1. Press the autozero filter gently into the filter socket at the top of the rear panel of the incubator.

5 Operation

5.1 Preparing for operation

WARNING! Risk of personal injury

- Do not forget to remove the sensor protective covers when putting the device into routine work. If they rest and cover the sensor, e.g. CO_2 will continuously flow into the incubator and possibly leak out of the device.

1. Remove the black protective cover from the CO_2 sensor, taking care not to remove the white porous cover.

   Store the black cover. The sensor cap should be placed back on the sensor when the incubator is to be cleaned.
2. Using the power cord provided, connect the incubator to a earthed/grounded power supply.
3. Switch the incubator on using the on/off switch at the rear of the cabinet.

   The display will illuminate immediately.
4. Turn on the CO_2 gas supply with the pressure regulator of the gas supply set to 0.05 MPa (0.5 bar 7.2 psi) unless operating with N_2 or O_2.
5. The chamber setpoints are pre-programmed at 37.0 °C and 5 % CO_2. Leave the incubator on until the programmed chamber temperature and CO_2 concentration have been reached.

   - The incubator's CO_2 valve is disabled until the incubator reaches the temperature setpoint. After the temperature setpoint is reached, the CO_2 valve is activated, allowing the incubator to reach the CO_2 setpoint.
   - If power is interrupted to the incubator long enough for the temperature to drop below setpoint, the CO_2 valve will be deactivated until temperature setpoint is again achieved. (This serves to avoid spurious CO_2 readings while the incubator is below its temperature setpoint)
6. Leave the incubator running for at least two hours (preferably overnight) to allow conditions to stabilize.

5.2 Using the humidity tray

NOTICE! Risk of material damage

- To avoid possible damage to the CO_2 sensor, never leave water in the humidity tray while the incubator is switched off, or when a high temperature disinfection cycle is initiated (optional feature).
- Allow a clearance of 15 – 20 cm (6 – 8 in) to allow access for oxygen sensor removal.

- The humidity tray should be left in place at all times.
- Use distilled water only in the humidity tray. Use of any other types of water including deionized water and chlorinated additives will cause corrosion inside the incubator.
- Do not move the incubator when a filled humidity tray is used. Spilled water could cause corrosion in the chamber.

If humidification is required:

1. Fill the humidity tray with 0.5 L of warm (around 37.0 °C) distilled water.
2. For cell culture work, we recommend adding a very small amount of copper sulphate in the humidity tray. Tests have shown that, in addition to inhibiting bacterial growth in the tray, this can reduce contamination on the chamber walls. Add one small teaspoonful (around 0.11 oz or 3.6 g) of copper sulphate to the water in the humidity tray.
3. To reduce the risk of contamination, clean the tray every 10 – 14 days with a solution of 70 % isopropyl alcohol and 30 % distilled water.

   Refill it with 0.5 liters of warm distilled water when clean.

The internal chamber will reach approximately 95 % relative humidity at 37 °C using the 0.5 L humidity tray.

5.3 Programming

5.3.1 Programming CO_2, O_2 and temperature

Perform the following steps to set the desired operating temperature, O_2 and CO_2 level.

1. Press the *PROG* function key.
2. In the *PROG* screen that appears, press the desired function key, *TEMP*, *O_2* or *CO_2*, then use the ◀and ▶direction keys to adjust the value.

   If the incubator is supplied with the option of oxygen control, the setpoint for the oxygen level can be selected and changed like the temperature and CO_2 setpoints.
3. When the desired setpoint is displayed, press the *ENTER* function key.
4. After making adjustments (if any were made), allow the incubator to stabilize at the setpoints before continuing.

   If the chamber temperature goes above the temperature setpoint by 1 °C, the over-temperature system will activate.

   Program the required oxygen level in the *PROG* screen, following the onscreen instructions. If you are running an O_2 level programmed between 0.1 - 0.9 %, you should know that the control system is set to operate in the following way to minimize N_2 consumption after the outer door has been opened:
   - The N_2 valve is switched on continuously until the O_2 level is within 0.1 % of setpoint.
   - The CO_2 valve is then switched on to allow the CO_2 level to reach setpoint. If the O_2 level is above setpoint 15 minutes after the N_2 valve has been switched off, it is switched back on for 40 seconds and the CO_2 valve is switched on for 20 seconds. The CO_2 valve will then pulse until setpoint is reached.
   - The process described above will repeat itself until the O_2 setpoint is reached.
   - The same process will also repeat if the O_2 level rises above setpoint, and if the O_2 level should rise toward 0.2 % above setpoint, the N_2 valve will open again continuously until the O_2 level returns to setpoint.
   - The CO_2 autozero, which would normally take place after a CO_2 alarm, will be cancelled to avoid the introduction of additional O_2 into the chamber. For the same reason, we recommend canceling the programmed CO_2 autozero.

5.3.2 User access code

Programmable user access code allows you to restrict access to the *PROG*, *USER*, and *ALARM* screens (where settings can be changed) to authorized persons only.

To set the user access code (if required):

1. Press the *PROG* function key to enter the *PROG* screen.
   The user access code will be displayed as a series of 4 asterisks.
2. Use the left and right direction keys to move to each code position, and the up and down direction keys to select a number from 0 – 9.
3. Once the number is selected, press the *ENTER* function key to save the code.
4. After returning to the main screen, programming access will require the code to make any further programming changes.

Take care to note your password somewhere. If a password is forgotten, you must contact a customer service representative to recover or delete the forgotten password.

5.3.3 Removing user access code

1. In the *PROG* screen, enter the current access code.
2. Now program *0000* as the new access code.
3. Press the *ENTER* function key to save the change.
   The code is now cancelled and programming is no longer restricted.

If the access code has been misplaced, you will be unable to make changes to your incubator's settings. Contact customer service or your service representative for instructions on how to regain access to your incubator.

5.4 Referencing the CO_2 sensor with autozero

Prior to using the incubator, you should manually perform a CO_2 Auto-Zero (see *PROGRAMMABLE CO_2 AUTOZERO on p. 32)*:

1. Perform a CO_2 autozero by pressing the *USER* function key (see *USER SETTINGS on p. 31)*, selecting *PROGRAMMABLE CO_2 AUTOZERO*, and pressing the *START* key.
2. The incubator will display a countdown as the autozero is running.
3. When the countdown is complete, the incubator is ready to use.

5.5 *USER SETTINGS*

In the *USER SETTINGS* screen, you can adjust the features called out on the screen.

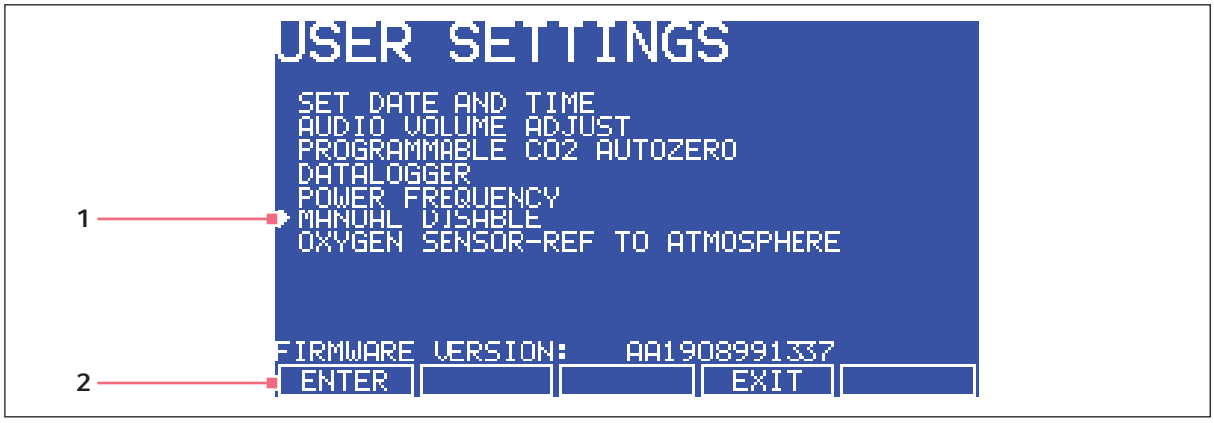


Fig. 5-1: *USER SETTINGS* screen

1 Use the ▲and ▼direction keys to move the cursor

2 Use the *ENTER* function key to select an option

This section explains each of the *USER* screen features. There are other *USER* options that may be displayed on screen if they are installed on your incubator. For a list of available options (see *Available options on p. 77)*.

5.5.1 *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 you change your clocks to Daylight Saving Time and back again to standard time. You may also select the style of display for the date.

5.5.2 *AUDIBLE ALARM VOLUME ADJUST*

The audible alarm volume can be adjusted to your own preferences.

5.5.3 *PROGRAMMABLE CO_2 AUTOZERO*

When you select this feature, the *PROGRAM CO_2 AUTOZERO* screen (see Fig. 5-2 on p. 32)allows you to program the autozero frequency and time, or to run the autozero function manually.

We recommend that you autozero the CO_2 system:

- Prior to using the incubator for the first time.
- Once a month when your incubator is operating, to ensure that the CO_2 level is as accurate as possible.
- After the incubator has been in storage (or transit) for a while.

The autozero system automatically re-references the CO_2 Sensor to atmospheric CO_2 in the following way:

1. A pump activates for two minutes, pumping atmosphere at 0.3 liters/minute into the sensor's measuring chamber. This displaces the chamber atmosphere completely from the sensor.

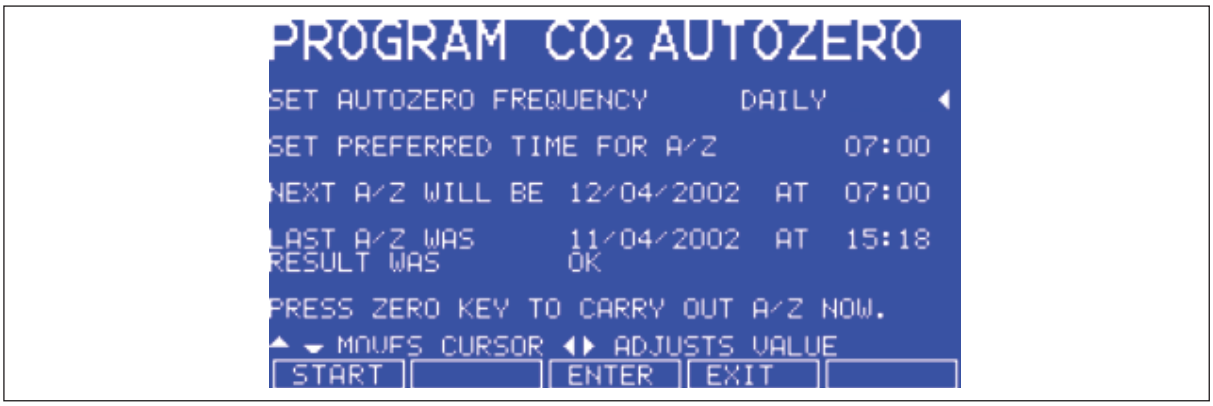


Fig. 5-2: *PROGRAM CO_2 AUTOZERO* screen

This procedure does not affect the internal chamber environment and will not affect your cell culture as it is being performed.

2. After the pump shuts off, the control system adjusts the autozero Factor to reference the sensor to 0.05 % CO_2, which is the approximate atmospheric level.
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 CO_2 control system takes over.
4. The result of the autozero (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 autozeroing can be set in steps between once a day and once every 28 days. The default setting is once every 28 days. If not required, it can be disabled (see *DISABLE on p. 33)*.

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

The autozero will only occur if the temperature is at setpoint. If the temperature is not at setpoint, the system will postpone autozero until the setpoint is achieved.

If the autozero function is to be run manually, simply press the *START* function key, within the *PROGRAM CO_2 AUTOZERO* window.

5.5.4 *DATALOGGER*

For detailed information (see *DATALOGGER on p. 35)*.

5.5.5 *POWER FREQUENCY*

You can adjust the power frequency to either 50 or 60 Hz to match the local mains/electrical supply. Use the ◀or ▶direction key until the correct frequency is displayed, then press the *ENTER* function key.

5.5.6 *DISABLE*

This feature allows you to inform the control system to ignore certain sensors if their function is not required. The standard item on this menu is the *CO_2 PRESSURE SWITCH* (for autozeroing). Additional Disable Options appear on this screen according to the options installed on your incubator, (see *Available options on p. 77)*.

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

5.5.7 *DISINFECTION* (optional)

NOTICE! Risk of material damage

- Make sure that the humidity tray is empty and dry, and that the O_2 sensor is removed before running high temperature disinfection.
- For O_2 option: Remove the O_2 sensor.

If the incubator is supplied with the high temperature disinfection option, the menu item *DISINFECTION* will be displayed. This feature activates the disinfection cycle of the incubator.

The disinfection cycle heats the inner chamber to 120 °C, holds that temperature for 4 hours, then cools the chamber to the selected temperature setpoint. All of the interior components (with the exception of the O_2 sensors, if present) can be left in place during the cycle to ensure that everything within the chamber is disinfected prior to resumption of activity. For a full explanation of this feature, (see *High temperature disinfection on p. 42)*.

5.6 *DATALOGGER*

The *DATALOGGER* screen displays the following information:

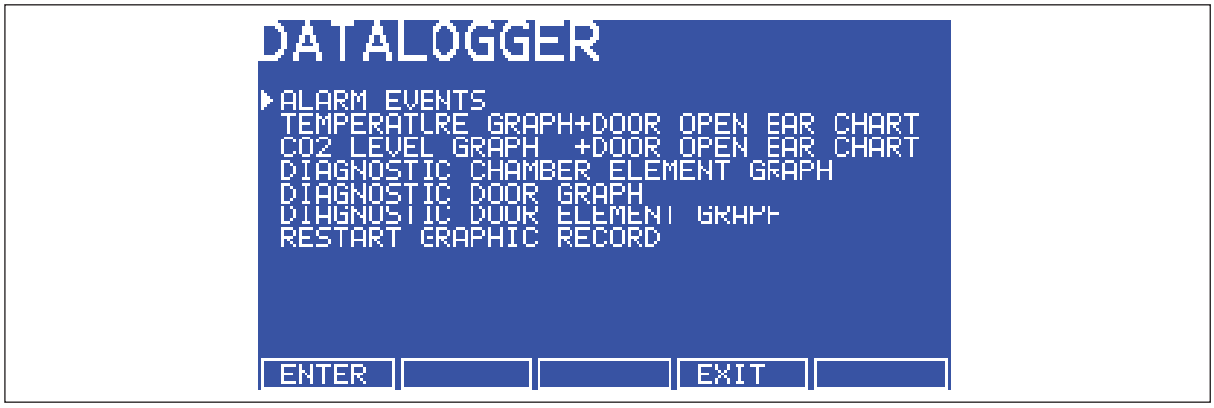


Fig. 5-3: *DATALOGGER* screen

5.6.1 *ALARM EVENTS*

The following alarm events are recorded in the order in which they occurred, with the most recent event displayed at the top:

- Power ON/OFF
- Chamber Temperature High/Low (programmed value)
- CO_2 Level High/Low (programmed value)
- CO_2 Supply Failure
- All System Alarms
- CO_2 Autozero (A/Z) Adjustments
- Oxygen and Relative Humidity (R/H) Alarms (where these options are installed)

The capacity is 99 events, after which the earliest event is overwritten and a later event is added.

The date and the time are also recorded for each event (see Fig. 5-4 on p. 36):

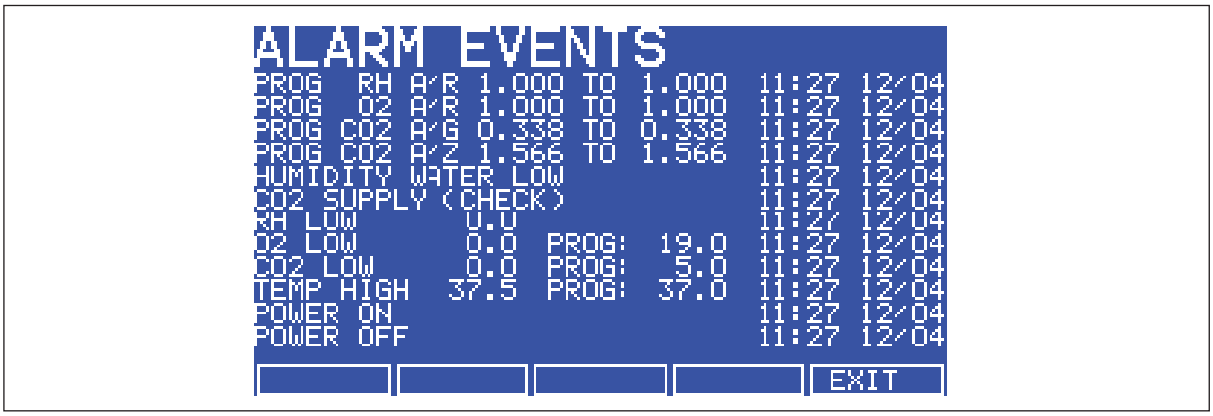


Fig. 5-4: *ALARM EVENTS* screen

5.6.2 *TEMPERATURE GRAPH + DOOR OPEN BAR CHART*

When you select this from the *DATALOGGER* screen, the Door Open bar chart is shown at the top of the screen to associate it with a temperature disturbance (see Fig. 5-5 on p. 37). A temperature reading is recorded every 18 seconds while the temperature is outside the specification of ±0.1 °C and each reading is shown as a single pixel.

When the temperature has settled within specification, the recording is compressed to one pixel representing (10) 18-second readings (as long as the temperature remains in specification). This allows up to 10 hours of readings to be displayed on one screen. When the temperature moves outside specification, for instance if the outer door is opened, the graph reverts to individual 18-second readings until temperature is within specification again.

When the data is compressed or decompressed, a light dotted line is displayed vertically on the screen to signify that the time axis is changing from 18-second to 10 x 18-second increments or vice versa (see Fig. 5-6 on p. 37).

A heavy dotted line (not shown) is displayed when the incubator is switched on.

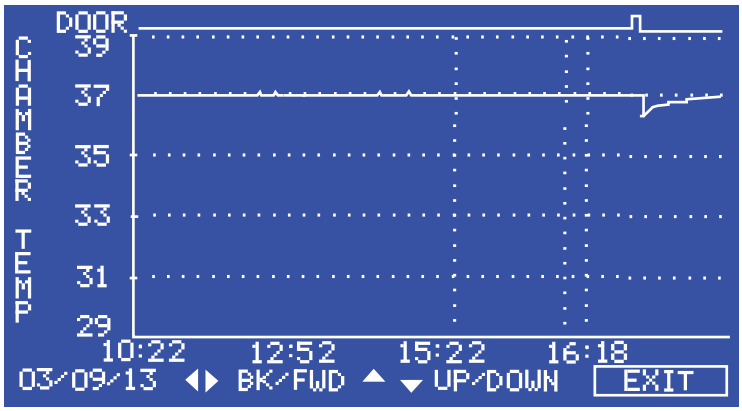


Fig. 5-5: *TEMPERATURE GRAPH + DOOR OPEN BAR CHART* screen

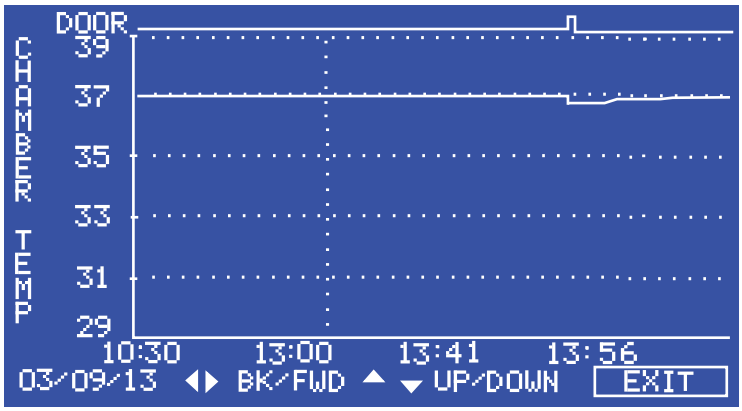


Fig. 5-6: Dotted vertical line showing compressed/decompressed data.

Compressing data allows memory space to be maximized. Once the memory space has been filled, the earliest events are overwritten as they are replaced by the latest recording. Graphical recording can be extended, however, to a number of years if your incubator is equipped with an RS-232 port, by connecting the port to a PC loaded with BioCommand® SFI Software (see *Accessories on p. 77)*.

5.6.3 *CO_2 GRAPH + DOOR OPEN BAR CHART*

These graphs record in a way similar to the Chamber Temperature graphs. The specification for CO_2 is ±0.1 %.

Both CO_2 and temperature graphs share the same time axis. If the time axis changes to accommodate data in one graph, it will also change in the other graph.

5.6.4 *DIAGNOSTIC CHAMBER ELEMENT GRAPH*

This graph records chamber element temperature over time to assist troubleshooting.

5.6.5 *DIAGNOSTIC DOOR GRAPH*

This graph records the door's inner surface temperature over time to assist troubleshooting.

5.6.6 *DIAGNOSTIC DOOR ELEMENT GRAPH*

This graph records door element temperature over time to assist troubleshooting.

5.6.7 *RESTART GRAPHIC RECORD*

This feature removes the current graph and begins a new one.

The data cannot be recovered once it is deleted.

5.7 *CHAMBER ALARMS*

To enter the *CHAMBER ALARMS* menu screen, press the *ALARM* function key on the main display. The *CHAMBER ALARMS* programming screen (see Fig. 5-7 on p. 38)allows the various alarm options to be selected and modified. Press the ▲or ▼direction key to move around the options and the ◀or ▶direction key to adjust values. The temperature and CO_2 high and low alarm setpoints automatically adjust to within ± 0.5 of the temperature and CO_2 setpoints. The alarm setpoints can also be manually adjusted.

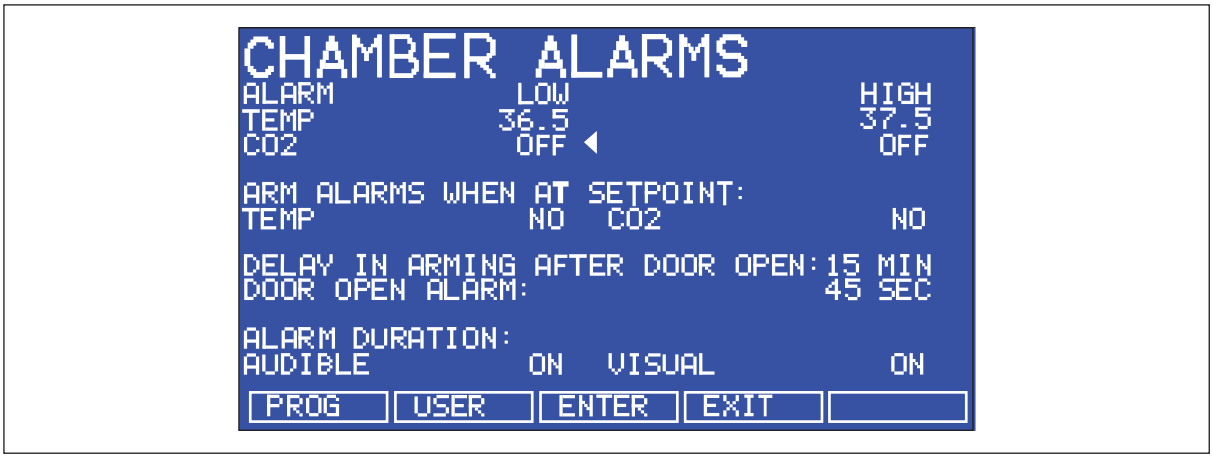


Fig. 5-7: *CHAMBER ALARMS* screen

5.7.1 Arm chamber alarms after selectable delay

1. Choose the option *ARM ALARMS WHEN AT SETPOINT*.
2. Select *NO* for both *TEMP* and *CO_2* (see Fig. 5-7 on p. 38).
3. Choose the option *DELAY IN ARMING AFTER DOOR OPEN* and select the desired delay (15 minutes in the sample screen (Fig. 5-7 on p. 38)) to allow for temperature and CO_2 recovery after the outer door has been opened.

5.7.2 Arm chamber alarms after setpoints are achieved

1. Choose the option *ARM ALARMS WHEN AT SETPOINT*.
2. Select *YES* for both *TEMP* and *CO_2*.
3. When *YES* is selected for this function, the *DELAY IN ARMING AFTER DOOR OPEN* is ignored.

5.7.3 Door open alarm

The *DOOR OPEN ALARM* can be adjusted and chosen from 7 preset durations (45 seconds in this example), (Fig. 5-7 on p. 38)to warn of an improperly closed outer door.

5.7.4 Audible and visual alarms

The audible and visual alarms can be adjusted from off to on (which means the alarm will be on continuously until it is acknowledged) in 7 preset time increments.

In the off position, any chamber alarms that occur will be displayed on the screen without flashing and with the audible alarm inhibited (see Fig. 5-7 on p. 38).

5.7.5 Chamber alarm system function

When the incubator is switched on, or after the temperature and CO_2 levels have been re-programmed, the alarm system is inactive until the setpoint values are achieved (within ±0.1), after which the alarm system is armed. CO_2 and temperature alarms are individually armed.

If temperature and/or CO_2 levels deviate more than the programmed setpoints, the display flashes, the audible alarm sounds and a message appears on the screen (see Fig. 5-8 on p. 40). Acknowledge the alarm by pressing any key.

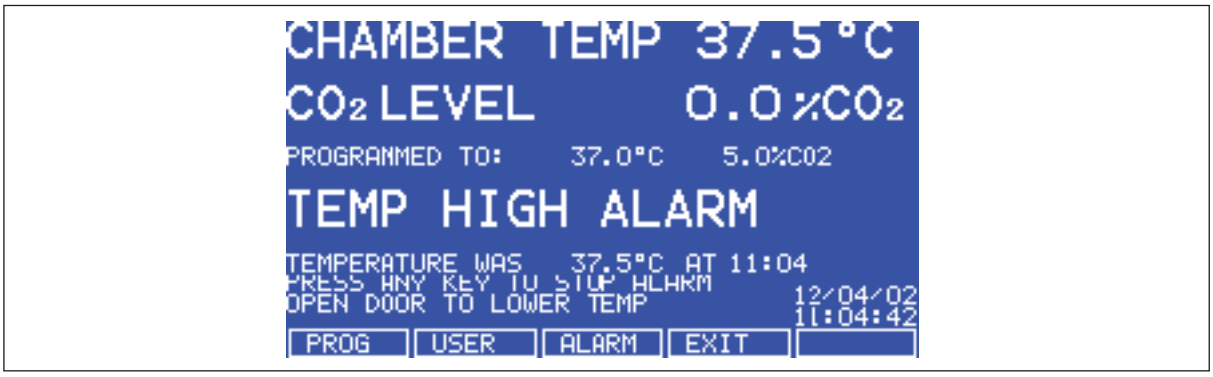


Fig. 5-8: *CHAMBER ALARM* message

After setpoints have been achieved for the first time, when the outer door is opened, the alarm system is disabled. Once the outer door is closed, a programmable alarm delay starts (if selected):

- If chamber conditions recover within the programmed alarm delay time, the alarm system is immediately re-armed. After the delay, the alarm system is armed and if the temperature and CO_2 are outside the alarm high and low settings, the alarm will be activated.
- If an alarm occurs and the chamber subsequently recovers, the alarm stops and the system is re-armed. Details of the alarm event are stored in the datalogger.

If the CO_2 valve is opened and no pressure is detected, an alarm occurs and a warning message appears on the screen, alerting you to *CHECK CO_2 SUPPLY* (see Fig. 5-9 on p. 40).

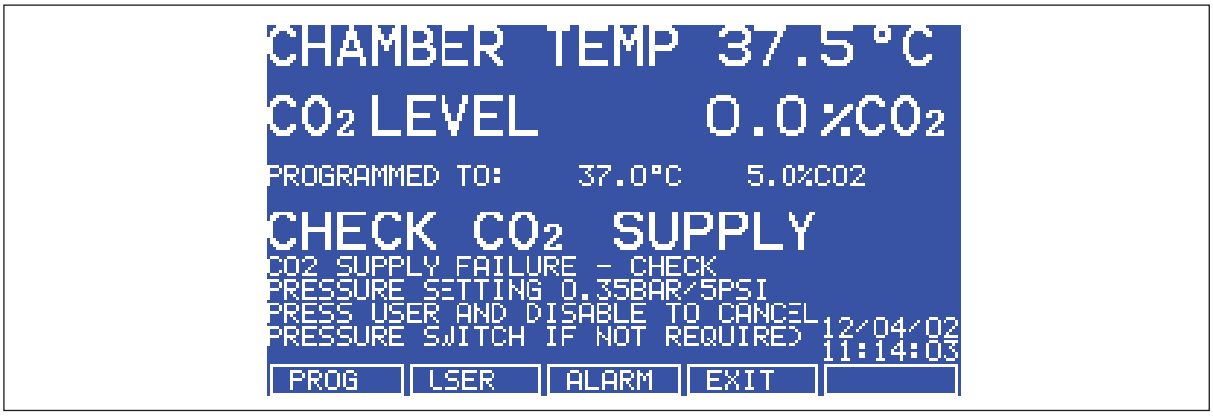


Fig. 5-9: *CHAMBER ALARM* to check CO_2 supply

Instructions to remedy the alarm are provided in the *ALARM* screen.

5.8 *DIAGNOSTICS* menu screen

The *DIAGNOSTICS* screen contains technical information regarding the status of many of the system components found on the incubator. This screen is mainly for technical service use, and can be used to troubleshoot the incubator systems before service is scheduled. This information allows technical support to optimize the service support required, and to shorten service time.

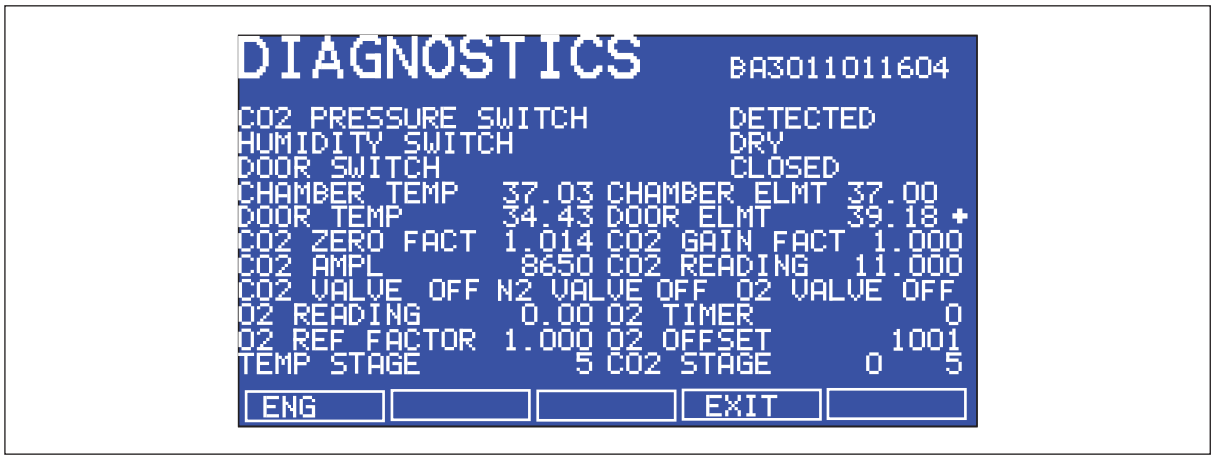


Fig. 5-10: *DIAGNOSTICS* screen

5.9 HELP MENU screen

The *HELP MENU* screen provides user-selectable categories of abbreviated information found in the user manual. All the major systems are covered in the help menu, including help on installing the incubator. If the user manual is misplaced, information about the CO_2 incubator and its functions can always be found on-screen.

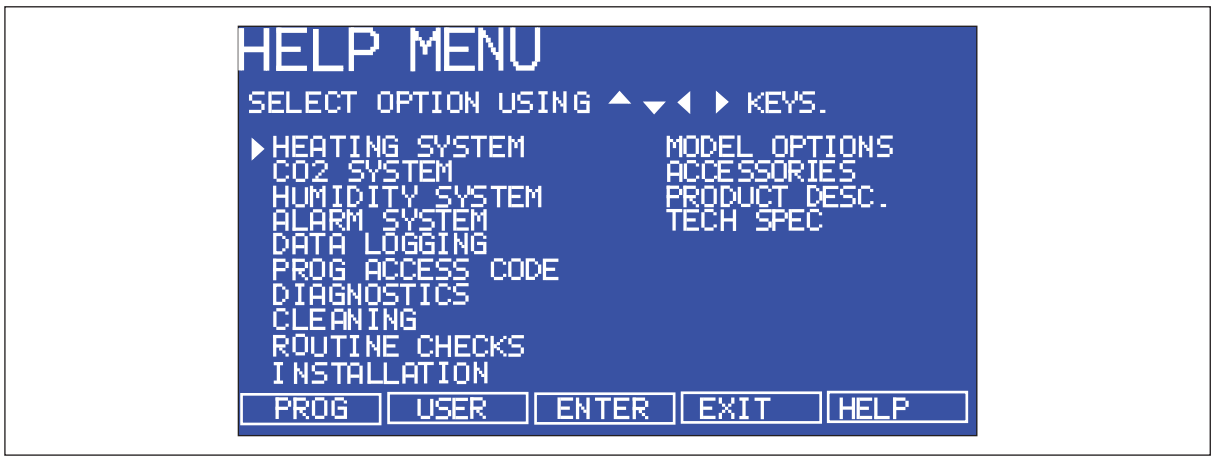


Fig. 5-11: *HELP MENU* Screen

5.10 High temperature disinfection

The high temperature disinfection option is designed to heat the internal chamber to 120 °C, maintain that temperature for 4 hours, and then allow the chamber to cool down to 37 °C or to the programmed temperature (if different from 37 °C) when normal control takes over. The cycle is designed to disinfect all internal surfaces and components, with the exception of the oxygen control sensor where supplied (see *High temperature disinfection option with oxygen control on p. 44)*.

5.10.1 Using the high temperature disinfection

Prerequisites

- The incubator should be cleaned, disinfected, and dried thoroughly before starting the cycle, (see *Cleaning on p. 67)*.
- The black protective cover must be removed (the white porous cover can remain in place).
- The shelves, shelf racks, humidity tray and silicone rubber feet and sleeves should all be in place during the cycle.
- The incubator MUST be clean and dry.
- The humidity tray MUST be empty, clean and dry.

WARNING! Risk of personal injury
Burns due to hot surface.

- ▸ Do not touch the equipment during the high temperature disinfection cycle.
- ▸ Do not open equipment door during the cycle.

NOTICE! Risk of material damage

- ▸ To avoid possible damage to the CO_2 sensor, never leave water in the humidity tray while the incubator is switched off, or when a high temperature disinfection cycle is initiated (optional feature).
- ▸ Allow a clearance of 15 – 20 cm (6 – 8 in) to allow access for oxygen sensor removal.
- ▸ For O_2 option: Remove the O_2 sensor.

1. Press the *USER* menu button, select *DISINFECTION* and press *START*. The incubator will then prompt: *IS CHAMBER CLEAN & DRY?* Answer *YES* if it is clean and dry.

   The cycle will start automatically, unless the incubator is fitted with oxygen control, in which case the incubator will also prompt: *IS O_2 SENSOR REMOVED?* Ensure that the O_2 sensor has been removed and answer *YES* to begin the cycle.

2. To cancel the cycle, press *CANCEL*. The incubator will cool down to the programmed level where normal control takes over.

   If an autozero is scheduled to begin prior to a disinfection cycle, the autozero will abort until the cycle is complete. A user initiated autozero will also abort but will not resume after completion of the disinfection cycle.

3. If the incubator outer door is opened during a disinfection cycle, the process will continue as normal, a failure message will occur due to low temperature.

   Certain areas of the glass of the outer door and door seal surface temperatures will be ±5 °C of 120 °C.

4. After completion of the process, one of the following status messages will be displayed. If the cycle:

   was completed successfully, *DISINFECTION COMPLETED OK* is shown.
   was cancelled by the user, *DISINFECTION WAS ABORTED* is shown.
   failed for any reason, *DISINFECTION FAILED [CODE: XX]* is shown.
   The following tables lists the disinfection failure codes and descriptions, (see Tab. on p. 43)and (see Tab. on p. 44). If this happens, note the failure code and contact your service representative for advice.

Tab. 5-1: Disinfection failure codes and descriptions

Failure code	Failure code description
01	Z
02	W
03	W, Z
04	X
05	X, Z
06	W, X
07	W, X, Z
08	Y
09	Y, Z
0A	W, Y
0B	W, Y, Z
0C	X, Y
0D	X, Y, Z
0E	W, X, Y
0F	W, X, Y, Z

Tab. 5-2: Disinfection failure code explanations

Failure code description	Explanation
W	Temperature drop during warm-up period: indicates the temperature fell more than 2 °C during the heating phase over a 60-second period.
X	Temperature drop during 4-hour period: indicates the temperature fell below 118.0 °C during the disinfection phase.
Y	Temperature increase during cool-down phase: indicates the temperature rose by more than 2 °C during the cooling phase over a 60-second period.
Z	Cancel key pressed.

- If the incubator power is cycled OFF then ON during a disinfection cycle due to a power outage, the incubator will power up as normal. This condition will be indicated by the absence of a completed disinfection status message (*DISINFECTION COMPLETED OK*).
- If the chamber temperature is above the setpoint or the element temperature is greater than a factory-preset control point, cool down will be entered until these conditions are satisfied.
- It is recommended that the autozero function be run following each disinfection cycle.

5.10.2 High temperature disinfection option with oxygen control

NOTICE! Risk of material damage

- To avoid possible damage to the CO_2 sensor, never leave water in the humidity tray while the incubator is switched off, or when a high temperature disinfection cycle is initiated (optional feature).
- Allow a clearance of 15 – 20 cm (6 – 8 in) to allow access for oxygen sensor removal.
- For O_2 option: Remove the O_2 sensor.

The oxygen sensor is an electrochemical device that will be destroyed by the high temperature used to disinfect the incubator if left in place. For this reason, the oxygen sensor must be removed from the incubator prior to a high temperature disinfection cycle. The sensor can be accessed from the rear panel of the incubator.

Detailed removal and installation instructions are provided (see *Oxygen sensor removal on p. 45)*.

5.11 Oxygen sensor removal

Prior to beginning a disinfection cycle, remove the oxygen sensor. For detailed instructions, (see *Removing and replacing O_2 sensor on p. 52)*.

1. Remove the black plastic plug that covers the oxygen sensor located on the back of the incubator.
2. Disconnect the sensor cable by unplugging the electrical connector (grasp the white connector body, not the wire leads).
3. Unscrew the oxygen sensor by turning it counter-clockwise. Never use excessive force or metal tools.
4. Store the sensor in a clean, safe place until the disinfection cycle is over.
5. The incubator is now ready to perform a disinfection cycle.

5.12 BMS relay contact alarm

The BMS (Building Management System) relay contact alarm allows a signal from a central alarm system to be switched ON or OFF to indicate an alarm condition at the incubator.

The following alarm conditions will activate the system:

- Over-temperature
- Under-temperature
- System failure
- CO_2 high
- CO_2 low

As an integral option, the alarm can be programmed to indicate when the power fails (perhaps due to an electrical fault) or is switched off. If the power failure warning is active, the relay contacts will be reversed (pin 4, which is normally open, becomes normally closed and pin 6, which is normally closed, becomes normally open). The alarm will also respond to other types of alarms, depending on the options installed on the incubator.

The system is connected at the rear of the incubator via a standard 6-pin DIN socket (see Fig. 5-12 on p. 46)for location. The matching plug is provided, when the option is installed.

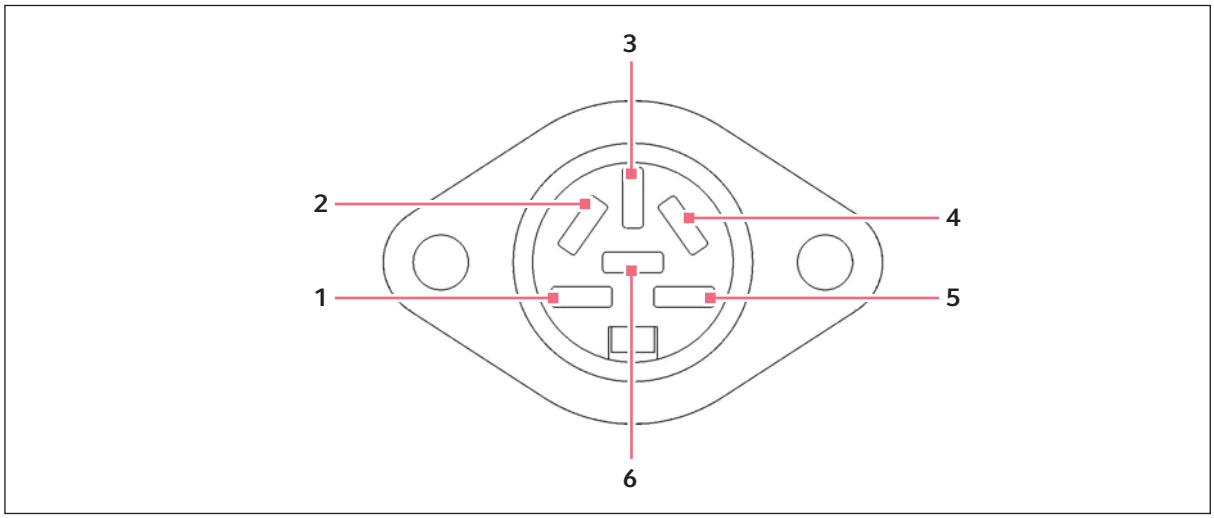


Fig. 5-12: BMS relay contact alarm socket

Pin	Designation	
1	24 V DC unregulated	To power external equipment such as a remote buzzer or light (100 mA maximum current available).*
2	0 V	
3	5 V DC	Via 10 K Ω pull-up resistor, for a logic signal to directly control an auxiliary control system.*
4	Normally closed	To access the relay contacts. Contact limits are 3 Amps @ 24 V DC and 3 Amps @ 34 V AC.
5	Common	
6	Normally open	

*Cable length should not exceed 3 m (9.8 ft) to comply with EMC requirements.

The default of Galaxy 48R setting for the alarm system is ON. To deactivate the relay using the incubator keypad:

1. Press *USER*.
2. Select *BMS ALARM RELAY*.
3. Select *MAKE ALARM RELAY ACTIVE YES/NO*.
4. Toggle to *NO* and then press *ENTER*.

The default setting for the power failure warning is *ON*. To make the alarm system ignore any power outage:

1. Press *USER*.
2. Select *BMS ALARM RELAY*.
3. Select M*AKE ALARM RELAY ACTIVE AT POWER SWITCH OFF/FAILURE YES/NO*.
4. Toggle to *NO* and then press *ENTER*.

5.13 O_2 control

5.13.1 Setting up the N_2 tank

Before setting up O_2 control, ensure that you have the proper equipment for your nitrogen supply:

- 2 cylinders of nitrogen, regulation size W
- (1) two-stage pressure regulator
- 10 mm outer diameter tubing with 6.5 mm inner diameter
- Tubing clips

To set up the nitrogen tanks:

1. Inspect the tanks to ensure that there are no leaks or other damage.
2. Check that the two-stage pressure regulator valve and the inline pressure regulator valve are closed by trying to turn their knobs in a counter-clockwise direction.

   The knobs should be at the stop point.
3. Attach supplied 6.5 mm bore tubing with large white filter to the gas inline pressure regulator's inlet on the left side of the control box at the rear of the incubator (see *Remove sensor (CO_2, O_2, and RH) protective cover (option dependent), and store for future use. on p. 21)*. Push the tubing into the rotatable tube connector of the inline regulator approximately 8 mm until it stops.
4. Test that the tubing is fixed by lightly pulling on it. It should not move.
5. Set up oxygen control based on your option: 1 – 19 % or 0.1 – 19 %.

For disconnecting the tubing press down the small ring of the tube connector and pull out the tubing.

5.13.2 Setting up oxygen control (0.1 – 19 %)

Oxygen control is tailored such that both the O_2 and the CO_2 levels are achieved at approximately the same time, via control of the N_2 valve's duty cycle (but within the range of 0.1 – 19 % O_2)

1. Remove the black plastic protective cover (making sure that the hydrophobic filter cap is not removed with it) from the port inside the chamber. Retain the cover for use when you clean the chamber.
2. Open the nitrogen gas supply from the tank and set the N_2 tank's outlet pressure gauge to 1.5 bar.
3. Set the N_2 inline pressure regulator to 0.1 MPa (1.0 bar, 14.5 psi). The gas flow rate is approximately 20 liters/minute.

- If the programmed O_2 level is close to the ambient oxygen, it may be necessary to reduce the cylinder pressure below 1 bar to stop the oxygen level from undershooting the programmed value.
- When working at 0.1 % O_2, set the CO_2 pressure to 0.1 MPa (1.0 bar, 14.5 psi).

Be sure to humidify the incubator and leave it overnight to stabilize before proceeding further.

To automatically calibrate the sensor to atmospheric oxygen levels, select *OXYGEN SENSOR – REF TO ATMOSPHERE* in the *USER* menu, and then follow the onscreen instructions.

The oxygen reading is automatically adjusted to 19.7 %, which is the true reading taking into account the relative humidity in the chamber.

Under normal humidity conditions (95 - 99 % RH), the sensor is unaffected. If for any reason (such as a large spill inside the chamber or the incubator being switched off while fully humidified) liquid condenses around the sensor, the result may be restriction of gas flow and a low sensor signal. Should such condensation appear on the chamber walls, normal operation can be easily restored by removing the humidity tray, drying the chamber completely, and then running the incubator at 37 °C for one hour. This will dry out the sensor. After the hour has elapsed, the humidity tray can be reinstalled and the incubator humidified again.

5.13.3 Setting up oxygen control (1 – 19 %)

This oxygen control option is designed to cover the 1 – 19 % range by adding nitrogen to bring the level below ambient.

1. Remove the black plastic protective cover from the hydrophobic filter cap (making sure that the hydrophobic filter cap is not removed with it), located in the rear wall of the incubator chamber. Retain the cover for use when you clean the chamber.
2. Open the nitrogen gas supply from the tank. Set the N_2 tank's outlet pressure gauge to 1.5 bar
3. Set the N_2 inline pressure regulator to 0.1 MPa (1.0 bar, 14.5 psi). The gas flow rate is approximately 20 liters/minute.

   If the programmed O_2 level is close to the ambient oxygen, it may be necessary to reduce the cylinder pressure below 1 bar to stop the oxygen level from undershooting the programmed value.
4. After the incubator has been humidified and left overnight to stabilize, select the *USER* menu; then, using the ▲or ▼direction key, select *OXYGEN SENSOR-REF TO ATMOSPHERE* and follow the onscreen instructions to automatically calibrate the oxygen sensor to atmospheric oxygen levels. The oxygen reading is automatically adjusted to 19.7 %, which is the true reading taking into account the relative humidity level.

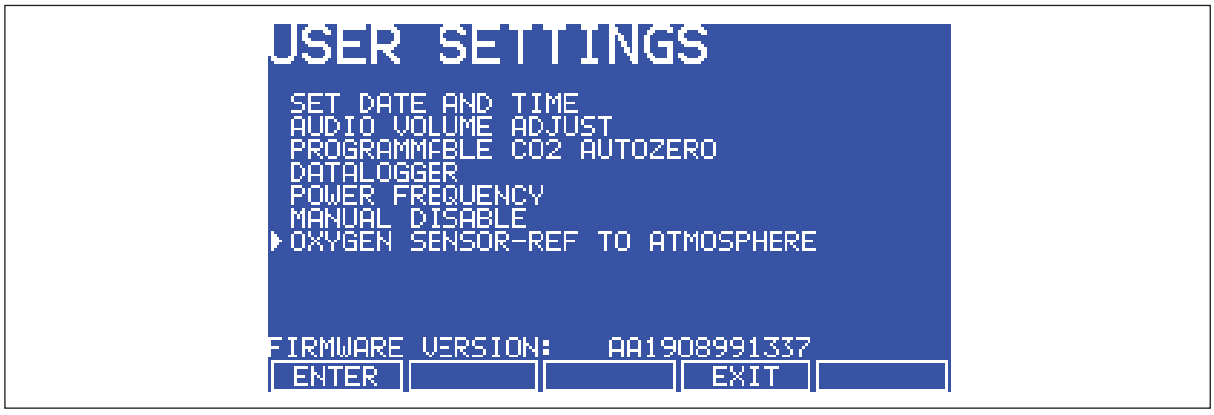


Fig. 5-13: Selecting *OXYGEN SENSOR-REF TO ATMOSPHERE*

5. Enable the oxygen control:
   1. Press the *USER* function key
   2. Using the ▲or ▼direction key, select *MANUAL DISABLE*
   3. Press the *ENTER* function key
   4. Select *ENABLE* for Oxygen Control using the ◀or ▶direction key
   5. Press the *ENTER* function key

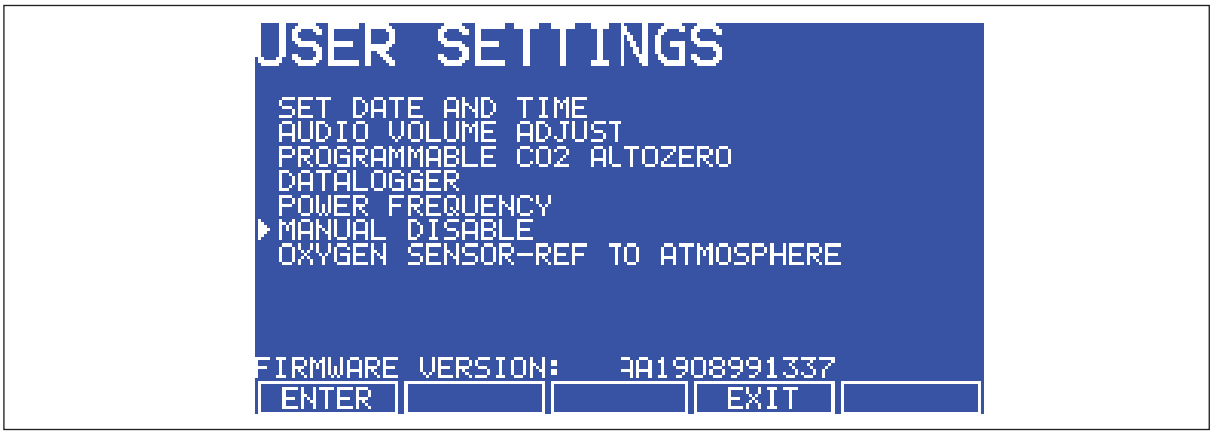


Fig. 5-14: *USER SETTINGS* screen

6. Navigate to the *PROG* screen to set the required oxygen level.
7. The alarm levels are automatically set to ± 0.5 % above or below the programmed value, but you can modify them in the *ALARM* screen. Re-arming the alarm can be delayed until the programmed value is achieved: select the relevant option in the *ALARM* screen.

   At low oxygen levels, the CO_2 and O_2 levels may not have fully recovered within the Alarm limits after the 15-minute "Delay in arming after door opening." This time period can be increased (in the *ALARM* screen) to suit individual circumstances.
8. By controlling the duty cycle of the N_2 valve, oxygen control can be tailored to achieve programmed oxygen and carbon dioxide levels at approximately the same time.

We recommend that you repeat the *OXYGEN SENSOR-REF TO ATMOSPHERE* procedure in step 4 (see *Referencing to atmosphere on p. 51)*, and further details once a month to ensure that any long-term drift in sensor output will be corrected. Be sure to do it at the chamber operating temperature.

When you are cleaning the chamber, be very careful not to wet the oxygen sensor or CO_2 sensor. Never use solvents on the sensor membrane; rather, be sure to cap the hydrophobic filter before you clean. It is good practice to replace the filter each time you clean the incubator chamber, to avoid the possibility of filter contamination.

Under normal relative humidity conditions (95 – 99 %), the oxygen sensor's performance should not be affected. If, however, liquid condenses around the sensor, gas flow may become restricted, giving the sensor a low signal. This may occur if there is a large liquid spill inside the chamber or if the incubator is turned off while it is fully humidified. Should such condensation appear, normal operation can be restored by:

1. Removing the humidity tray,
2. Drying the chamber completely,
   Running the incubator at 37 °C for one hour.

This will dry out the sensor(s). The humidity tray can then be reinstalled and the incubator can be safely re-humidified.

5.14 Referencing to atmosphere

The oxygen sensor is a self-powered electrochemical cell with a finite life that is dependent on the ambient oxygen level. A typical lifespan is 1 – 2 years at atmospheric levels. During the sensor's lifespan, the signal produced will slowly degrade until it is ultimately unuseable. For this reason, we recommend that you reference the sensor to atmospheric oxygen levels on a monthly basis.

To reference the sensor to atmosphere, enter the *USER* menu and select *OXYGEN SENSOR-REF TO ATMOSPHERE*.

This procedure has 3 possible outcomes:

1. The test was completely successful, and no further action is needed until the next month's test.
2. The sensor needs to be replaced soon (see *Replace sensor soon on p. 51)*.
   The sensor needs to be replaced immediately (see *Replace sensor now on p. 52)*.

5.15 Oxygen sensor replacement

If you complete a referencing procedure and the O_2 sensor is not functioning at 100%, you will recieve 1 of 2 messages: *O_2 REFERENCE OK BUT SENSOR REQUIRES REPLACEMENT SHORTLY* (see *Replace sensor soon on p. 51)*, or *O_2 REFERENCE FAILED* (see *Replace sensor now on p. 52)*if the sensor is no longer functioning.

5.15.1 Replace sensor soon

If the referencing procedure was successful but the sensor is nearing the end of its working life, the following message will appear in the display:

O_2 REFERENCE OK BUT SENSOR REQUIRES REPLACEMENT SHORTLY

PRESS ENTER TO PROCEED

When you press the *ENTER* function key, the message will change to this:

O_2 SENSOR

THE RESULT OF THE O_2 REFERENCE PROCESS SHOWS THAT THE SIGNAL FROM THE O_2 SENSOR HAS REDUCED INDICATING IT IS APPROACHING THE END OF ITS LIFE.

REPEAT THE REFERENCE PROCEDURE TO CONFIRM THIS RESULT.

PRESS ENTER TO PROCEED.

Press the *ENTER* function key.

5.15.2 Replace sensor now

If the referencing procedure failed, oxygen control will be disabled. The incubator will appear to be functioning as normal until a new sensor is installed and referenced to atmospheric level. The following message will appear in the display:

O_2 REFERENCE FAILED

PRESS ENTER TO PROCEED

When you press the *ENTER* function key, the message will change to this:

O_2 SENSOR

THE RESULT OF THE O_2 REFERENCE PROCESS SHOWS THAT THE SIGNAL FROM THE O_2 SENSOR HAS REDUCED BELOW AN ACCEPTABLE LEVEL AND HAS REACHED THE END OF ITS LIFE.

REPEAT THE REFERENCE PROCEDURE TO CONFIRM THIS RESULT.

PRESS NEXT TO PROCEED.

When you press the *NEXT* function key, the message will change to this:

O_2 SENSOR

OXYGEN CONTROL HAS BEEN DISABLED AS A RESULT BUT THE INCUBATOR IS OTHERWISE FULLY OPERATIONAL.

PRESS PREV TO VIEW PREVIOUS SCREEN. PRESS EXIT TO EXIT.

When you press the *EXIT* function key, you will return to the *USER* screen and normal operation.

5.15.3 Removing and replacing O_2 sensor

Prerequisites

- Oxygen sensor removal tool (see Fig. 5-16 on p. 53)

NOTICE! Risk of material damage

- Grasp white connector body when disconnecting wire leads.
- Do not pull on wire leads.

To remove and replace the oxygen sensor, you will need the sensor removal tool provided (see Fig. 5-16 on p. 53).

1. Pull the rear access cover off the rear outside wall of the incubator to gain access to the oxygen sensor.

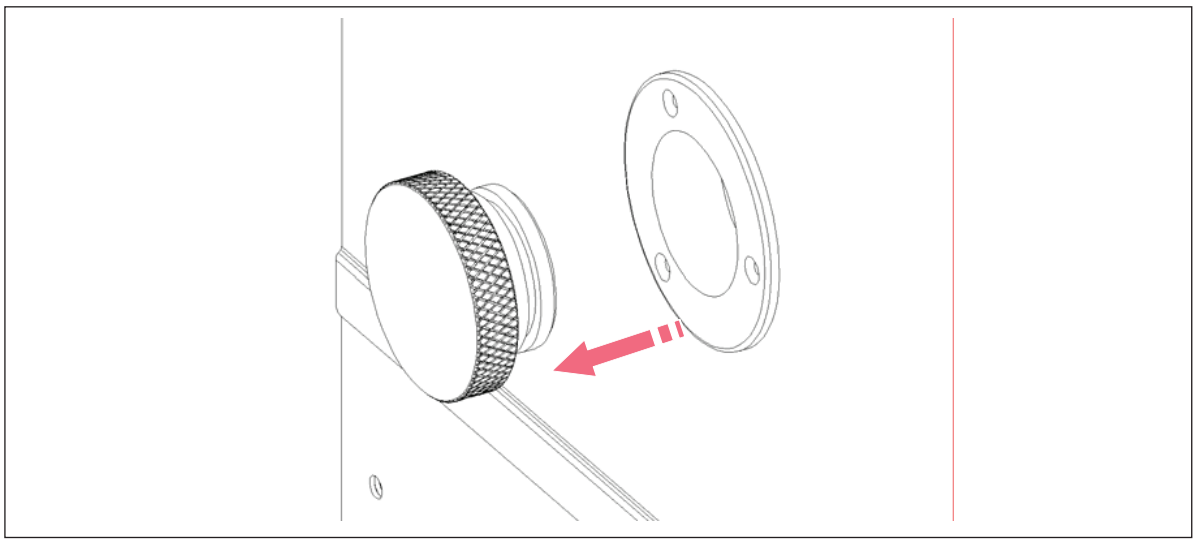


Fig. 5-15: Oxygen sensor rear access cover

2. Reach inside and disconnect the sensor by unplugging the connector: be sure to grasp the white connector body.
3. Using the sensor removal tool (see Fig. 5-16 on p. 53), unscrew the oxygen sensor by turning it counter-clockwise. Because the oxygen sensor contains lead, be sure to dispose of it according to local regulations.

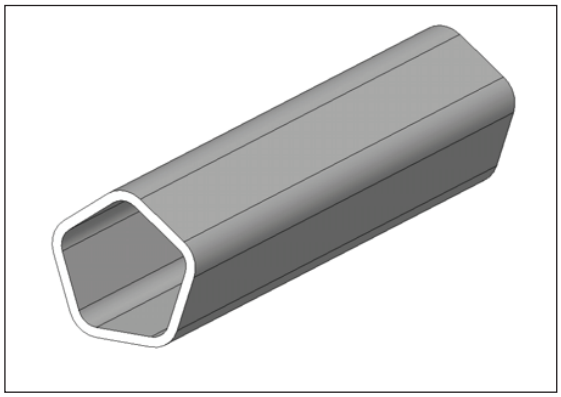


Fig. 5-16: Oxygen sensor removal tool

4. If you want to do an HTD, stop the procedure after this step. During the HTD the white connector should be outside the device as shown. Carefully put the rear access cover back in place. Make sure that the cables are not damaged.

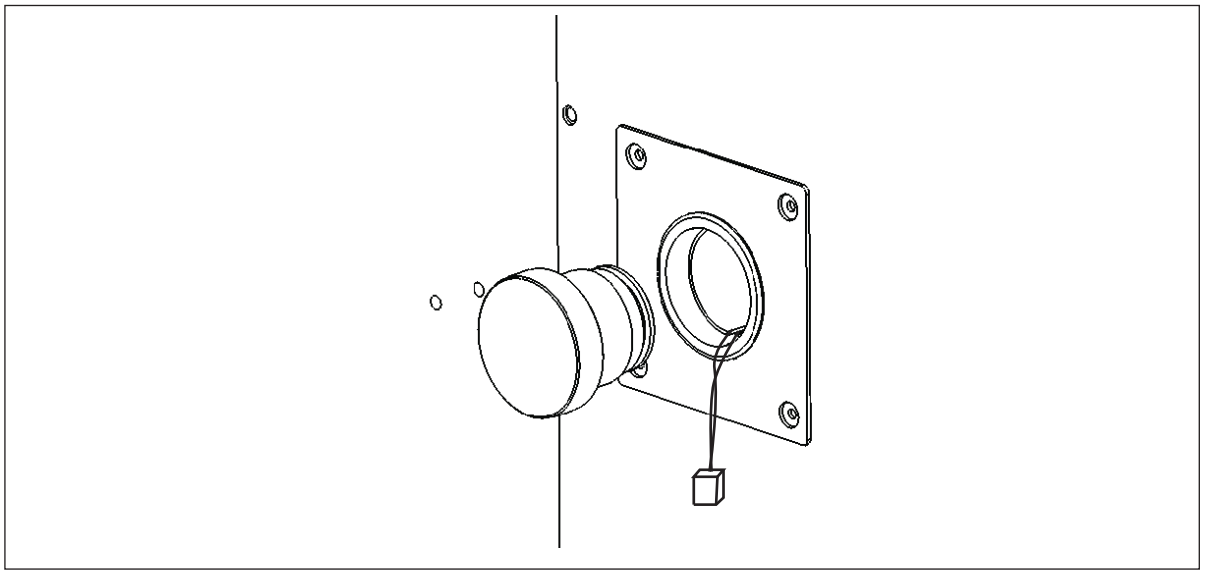


Fig. 5-17: Oxygen sensor rear access cover

5. Using the sensor removal tool, install the new oxygen sensor by turning it clockwise until it is finger-tight. Do not use excessive force or any metal tool.
6. Reconnect the sensor by plugging the white connector body back in.
7. Make sure that the sensor wires are inside the metal sensor tube to protect them from damage, then press the rear access cover snugly back in place.
8. After replacing the sensor, humidify the incubator and allow it to stabilize overnight.
9. Calibrate the sensor with reference to the atmospheric oxygen level (see *Referencing to atmosphere on p. 51)*.

5.16 Replacing the filter disc

The hydrophobic filter installed on your oxygen control system helps prevent condensation from reaching the sensor.

1. Carefully pull the complete hydrophobic filter holder away from the oxygen sensor holder on the rear wall of the chamber.
2. With a fingertip or a 10 - 11 mm (½ in) rod, from the rear of the filter holder, gently push the filter membrane disc and the filter cap out of the holder.
3. Clean and dry the filter holder and cap.
4. Wearing gloves to avoid contaminating the filter disc, gently place the new filter membrane disc into the filter holder recess. The filter disc works in both directions, so there is no right or wrong side.

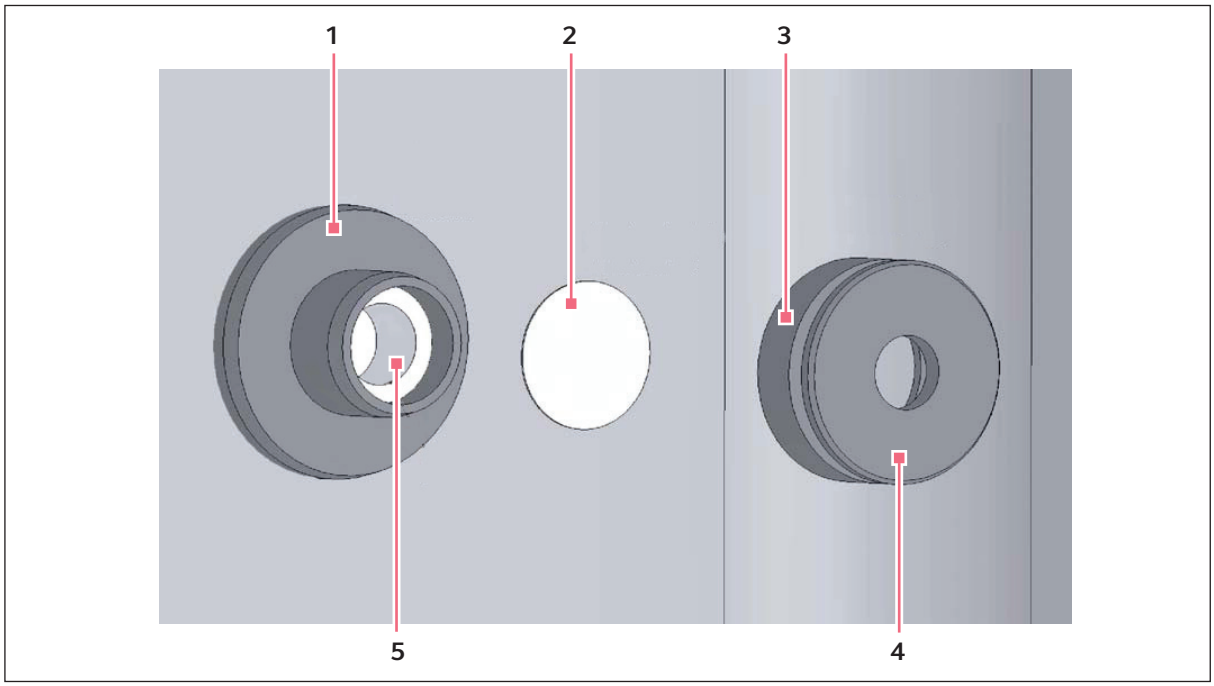


Fig. 5-18: Hydrophobic filter and holder assembly (exploded view)

1 Oxygen sensor holder

2 Hydrophobic filter disc

3 Hydrophobic filter holder

4 Hydrophobic filter cap

5 Oxygen sensor

5. Make sure the O-rings (between the cap & filter holder and between the filter holder & oxygen sensor holder) are undamaged and securely in place.
6. Gently press the filter cap back in.
7. Press fit the filter assembly back onto the oxygen sensor holder.

5.17 Humidity alert and monitoring package

The humidity alert package includes a humidity tray warning system and humidity display and alarm function, both providing optimal feedback on relative humidity inside the incubator chamber.

5.17.1 Humidity tray warning system

The humidity tray warning system is designed to prevent the water level in the humidity reservoir from becoming too low. The water level is continuously measured by an optical water level sensor. If the water level in the humidity tray become too low a *HUMIDITY WATER LOW ALARM* is displayed. This alarm can be cancelled by pressing any key, but it will re-activate when the door is opened and closed.

The humidity alarm system can be deactivated as follows:

Humidity tray warning system with high temperature decontamination option.

NOTICE! Risk of damage to equipment
The humidity warning sensor can not be dismantled.

- Never bend the metal tube which came from the back side of the chamber. Just flip the downward part (with the sensor) with the rubber tube to take out the water tray.

1. Press *USER*.
2. Select *DISABLE* and toggle *HUMIDITY WARNING* from *ON* to *OFF* using the ◀▶ keys.
3. Press *ENTER*.
4. Refill the humidity tray with 0.5 liters of warm (~37.0 °C) distilled water.

When the water level has been replenished and the door is closed the system will re-arm.

5.17.2 Humidity display and alarm system

The humidity display and alarm system is designed to measure the relative humidity level (rH) in the chamber and to display the chamber rH on the display screen. Under normal operating conditions and using the supplied humidity tray, the rH level will reach a maximum of 95 - 96 % after being left overnight. The humidity sensor will activate an alarm if relative humidity falls below the preset limit of 88 %. The sensor is located on the rear wall of the chamber, below the CO_2 Sensor. The humidity display is always active, but the alarm system can be deactivated as follows:

1. Press *USER*.
2. Select *DISABLE*, and toggle *RELATIVE HUMIDITY* from *ON* to *OFF* using the ◀▶keys.
3. Press *ENTER*.

The alarm system is disarmed for 1 hour or when it achieves 88% R/H, when the incubator is switched on, or if the door is opened and closed.

An alarm is signaled by a flashing *RH LOW ALARM* message. If the humidity level rises above 88 % during the 1 hour time out period, the humidity alarm system will be armed. The alarm will then be triggered when the R/H level falls below 88 % and will be recorded by the alarm log. The alarm can be acknowledged by pressing any key. No further alarms will occur unless the door is opened and closed, or power to the incubator is removed then restored.

The humidity sensor is protected by a white porous plastic cover, care must be taken not to spill any liquid into the sensor. The white porous cover should be protected with the black plastic sleeve provided when cleaning the incubator. The white porous cover can be removed and autoclaved but care should be taken not to touch or wet the sensor when the cover is removed.

5.18 RS-232 interface

An external computer can be connected to the serial interface for data logging using optional BioCommand SFI software, or by remote control with a communication program. Data from the incubator can be downloaded for record keeping or validation documentation. The device can be controlled remotely and operating parameters can be transmitted and recorded using third party software. Information on installing and operating the communication program can be found in the corresponding software documentation.

The RS-232 interface port provides a connection for the incubator to a personal computer or terminal. This allows the incubator's operating status to be viewed on the screen.

The computer should be connected to a mains/power supply outlet as close as possible to the incubator.

Prerequisites

- A PC or terminal, capable of RS-232 communication, with one serial com port free for this connection or a serial interface box.
- A null-modem screened cable of suitable length. To ensure reliable communication, the cable should not exceed 15 m (49 ft) in length. One end must have a 9-pin female D connector, to connect to the incubator's RS-232 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 New Brunswick's BioCommand SFI or HyperTerminal (included with Windows® NT, 95, 98, ME, 2000 and XP).

The incubator requires the following settings in the communications software:

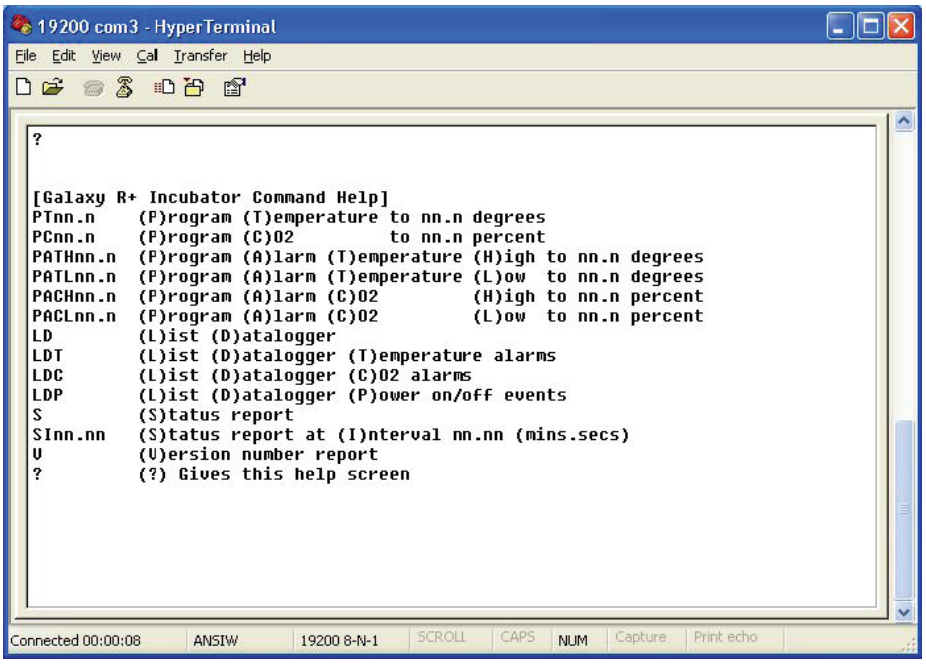
Tab. 5-3: Communication settings

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

To use the RS-232 interface:

1. Connect the null-modem cable to the RS-232 port at the rear of the incubator.
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 7 and then skip to Step 9. If not, continue to Steps 7 and 8.
5. Using the communications software, select the unused port (COM1, COM2, COM3, etc.) then press the *ENTER* key on the PC/terminal keyboard (refer to BioCommand SFI operating manual for instructions).

   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. This menu will appear on the computer screen:



This menu allows the incubator temperature, CO_2 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:

Tab. 5-4: Remote programming

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 query 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:

Tab. 5-5: Status commands

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* *CO_2: Actual 05.0 % Setpoint 05.0 %*
SInn.nn	(S)tatus report at (I)nterval of n minutes, n seconds. Type *SI60.0*, 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:

Tab. 5-6: Other 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:

Tab. 5-7: Messages

Type of Message	**Message**
Alarm	*TEMPERATURE LOW*
Alarm	*TEMPERATURE HIGH*
Alarm	*CO_2 LOW*
Alarm	*CO_2 HIGH*
Alarm	*TEMPERATURE SENSOR FAILURE*
Alarm (Autozero)	*PROG CO_2 A/Z SYSTEM INOPERATIVE*
Autozero Event	*PROG CO_2 A/Z 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

CO_2: Actual 00.1 % Setpoint 05.0 %

6 Troubleshooting

6.1 O_2 sensor

If the oxygen sensor fails suddenly, it is very likely that the sensor inlet membrane has become blocked by condensation. This can be seen on the *DATALOGGER* screen as a sudden drop from the programmed value to nearly zero.

To dry the membrane:

1. Remove the humidity tray.
2. Remove the hydrophobic filter holder assembly (see *Replacing the filter disc on p. 54)*by unscrewing it (counter-clockwise).
3. Program the incubator for a temperature of at least 37 °C (or higher if you normally operate the incubator at a higher temperature).
4. Close the door and allow the temperature to recover.
5. Reopen the door for 15 seconds to release any build-up of humidity.
6. Repeat steps 3 and 4 every 30 minutes while monitoring the *DATALOGGER O_2* Graph. The oxygen level should recover after a few hours.
7. Leave the incubator for a few more hours to be ensure that the sensor membrane has thoroughly dried out.
8. Replace the hydrophobic filter disc (see *Replacing the filter disc on p. 54)*.
9. Re-humidify the incubator.
10. After 2 to 3 hours, carry out an *OXYGEN SENSOR-REF TO ATMOSPHERE* (see *Referencing to atmosphere on p. 51)*. When the referencing has been successfully completed, the incubator is ready for use.

7 Maintenance

7.1 Routine maintenance

7.1.1 General

WARNING! Risk of injury to personnel or damage to equipment!

- 2 stacked incubators should not be moved for maintenance or cleaning.

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

If you are using the humidity tray for humidification, (see *Using the humidity tray on p. 28)*.

7.1.2 Daily checks

1. Check that the temperature and CO_2 levels are reading within specification.
2. Check the reserve pressure in the CO_2 cylinder (normally 725 PSI (50 bar) when full). The design of the incubator ensures very low consumption of CO_2. 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 of 725 PSI (50 bar), it means that the cylinder is almost empty and should be replaced. Ensuring that there are no leaks at any of the connections will ensure a greater lifetime to the CO_2 supply and will help avoid accidentally running out of CO_2.
3. Any spills in the chamber should be cleaned immediately.
4. Check the *DATALOGGER* screen for any alarms or events that may have occurred overnight.

7.1.3 Weekly checks

Use distilled water only in the humidity tray. Use of any other types of water including deionized water and chlorinated additives will cause corrosion inside the incubator.

Refill the humidity tray with 0.5 liters of distilled water. The use of warm water will ensure a rapid return to optimum chamber conditions.

7.1.4 Monthly checks

We recommend routine replacement of the water in the humidity tray, and that you clean the tray at the same time.

If required, you can take a sample of the gas inside the chamber using the CO_2 sample port, and check it using a CO_2 gas analyzer (see *Accessories on p. 77)*.

Displayed chamber CO_2 level will drop during sampling, but it will recover once the sampling is complete. This is merely a sensor characteristic; the CO_2 level in the chamber is actually not affected.
We recommend that you perform a CO_2 autozero prior to sampling. We also recommend that you autozero the CO_2 system at least once every 28 days to ensure that CO_2 level is correct.

7.1.5 CO_2 Sampling with analyzer

The CO_2 sample port is located on the rear of the incubator, near the top (see Fig. 3-1 on p. 13).

If you conduct a sampling, please ensure the following:

- Turn off the CO_2 gas by re-programming the setpoint for CO_2 to 0.0 % to prevent CO_2 from being injected into the chamber and giving a false reading.
- A flow rate ≤ 0.5 liters/minute is used to take a sample.
- The door is kept closed.
- Reset the CO_2 setpoint to the desired level after sampling.

We recommend that you perform a CO_2 autozero prior to sampling. We also recommend that you autozero the CO_2 system at least once every 28 days to ensure that CO_2 level is correct.

7.2 Cleaning

DANGER! Electric shock

- Switch the device off and pull the power plug out of the socket before beginning work.

NOTICE! Damage due to incorrect cleaning agent or sharp objects
Unsuitable cleaning agents can damage the display, surfaces and printing.

- Never use corrosive cleaning agents, strong solvents or abrasive polishes.
- Do not use acetone to clean the device.
- Do not use sharp objects to clean the device.

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.

7.3 Disinfection/Decontamination

DANGER! Danger from exposure to decontamination agents.

- Wear appropriate laboratory clothing, protective gloves and safety glasses.
- Wear breathing protection if you work with particulate matter.

NOTICE! Risk of material damage

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

Use the decontamination method recommended by the manufacturer.
If you would like to use a different method, contact Eppendorf to prevent the device from becoming damaged.
If you have any further questions regarding the cleaning and disinfection or decontamination and the cleaning agents to be used, contact Eppendorf.
The contact details are provided on the back of this manual.

NOTICE! Risk of material damage

- It is very important to ensure that no liquid is spilled onto the white porous CO_2 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.

Use distilled water only in the humidity tray. Use of any other types of water included deionized water and chlorinated additives will cause corrosion inside the incubator.

The recommended disinfecting agent for use with the incubator is a solution of 70 % isopropanol (isopropyl alcohol) and 30 % distilled water. Be sure to follow appropriate safety regulations while you are using this solution.

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

1. Program 0.0 % CO_2 and switch off the incubator. Unplug the incubator from the mains/power supply.
2. Dampen a clean cloth with the alcohol solution and wipe down all external surfaces, taking care to keep the alcohol solution from coming into contact with any mains/electrical outlets or assemblies.
3. Remove all of the shelves, the humidity tray, and the shelf racks.
4. Place the black protective cover over the CO_2 sensor. Also protect any additional sensors, such as Oxygen or Humidity, with the cover(s) supplied.
5. You can clean the humidity tray by rinsing it in sterile water, wiping it down with the alcohol solution, and then rinsing it again with sterile water.
6. Wipe down the inside of the chamber with the alcohol/water solution, and leave it to dry completely.
7. Wipe the internal components of the chamber twice with the alcohol/water solution. Wipe off 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 it to dry.
9. Ensure the protective cover(s) are removed from all sensor(s) and replaced in the holder for safekeeping. Be very careful, as you remove the black CO_2 sensor cover, not to accidentally remove the white porous sensor cover. This must remain in place.
10. Refill the humidity tray (see *Using the humidity tray on p. 28)*. 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 stabilize.
12. When the incubator has stabilized, carry out an autozero and reprogram the desired CO_2 level. It may be necessary to open the glass door briefly if, after performing an autozero, the CO_2 level is too high.

7.4 High temperature disinfection

If your incubator is supplied with the High Temperature Disinfection option, follow the guidelines outlined (see *High temperature disinfection on p. 42)*for information on how to correctly and safely operate this option.

8 Transport, storage and disposal

8.1 Transport

NOTICE! Risk of material damage

- Never try to lift the incubator by its door; this would cause permanent damage to the incubator.

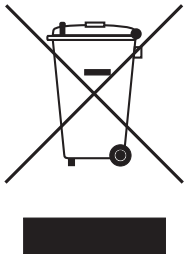
8.2 Disposal

In case the product is to be disposed of, the relevant legal regulations are to be observed.

Information on the disposal of electrical and electronic devices in the European Community:

Within the European Community, the disposal of electrical devices is regulated by national regulations based on EU Directive 2012/19/EU pertaining to waste electrical and electronic equipment (WEEE).

According to these regulations, any devices supplied after August 13, 2005, in the business-to-business sphere, to which this product is assigned, may no longer be disposed of in municipal or domestic waste. To document this, they have been marked with the following identification:



Because disposal regulations may differ from one country to another within the EU, please contact your supplier if necessary.

In Germany, this is mandatory from March 23, 2006. From this date, the manufacturer has to offer a suitable method of return for all devices supplied after August 13, 2005. For all devices supplied before August 13, 2005, the last user is responsible for the correct disposal.

8.3 Storage

Store incubator in ambient conditions of 10 °C - 50 °C.

9 Technical data

9.1 Weight/dimensions

9.1.1 Equipment dimensions

Width	48.9 cm (19.3 in)
Height	65.2 cm (25.7 in)
Depth	49.7 cm (19.6 in)
Net weight	31.8 kg (70.1 lb)

9.1.2 Internal dimensions

Width	40.1 cm (15.8 in)
Height	40.1 cm (15.8 in)
Depth	30.5 cm (12.0 in)
Volume	48 liters (12.7 gallons)

9.1.3 Transporting dimensions

Width	70.0 cm (27.6 in), pallet included
Height	87.5 cm (34.4 in), pallet included
Depth	60.0 cm (23.6 in), pallet included
Weight	50 kg (110.2 lb)

9.1.4 Shelves

Polished stainless steel, perforated (standard).

Usable area:	875 cm^2 (344.5 in^2)
Number of shelves:	• 3 standard; upgrade to 6 shelves with multiple position rack (standard)

9.2 Power supply

9.2.1 Mains/electrical supply

Mains/power connection	110 V - 120 V ± 10 %, 50 Hz – 60 Hz 220 V – 240 V ± 10 %, 50 Hz – 60 Hz
Power consumption for 110 V – 120 V	500 W
Power consumption for 220 V – 240 V	1000 W
Energy to maintain 37 °C	< 0.1 kWh
Max. power consumption during normal application 110 V – 120 V 220 V – 240 V	 250 W 400 W
Max. power consumption during high temperature disinfection 110 V – 120 V 220 V – 240 V	 500 W 1000 W

9.3 Ambient conditions

9.3.1 Ambient operating conditions

Ambient temperature	15 °C – 28 °C
Altitude limit	2000 m

9.3.2 Temperature management

- Digital programming via microprocessor control in 0.1 °C increments.
- Measurement of chamber and door temperature via 4 RT (Resistance Temperature curve) 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 °C – 25 °C

If ambient temperature is close to the programmed value, control settings may need adjusting. Please consult Eppendorf Service for instructions.

9.3.3 CO_2 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 %
Uniformity	±0.1 %
Gas connections	OD-10 mm and ID-6.5 mm
Required gas pressure	0.05 MPa (0.5 bar 7.2 psi)

9.3.4 Relative humidity

Removable stainless steel humidity tray.

Reservoir capacity	0.5 liters
Humidity control: manual	95 % at 37 °C

9.3.5 Storage temperature

Air temperature	10 °C – 50 °C

9.4 Oxygen sensor specifications

The Oxygen Control option has the following characteristics:

Sensor type	Self-powered, diffusion-limited, electrochemical cell with temperature compensation
Zero signal in Nitrogen	< 50 µV
Temperature compensation	±2 % of signal variation from 0 – 40 °C
Relative humidity range	0 – 99 %, non-condensing
Operating temperature range	-20 °C to +50 °C
Resolution	0.01 % Oxygen
Expected operating life	1 – 2 years in ambient oxygen
Hydrophobic filter operating life	No data available on the filter lifespan but we are confident to expect it will last at least 6 months
Nitrogen input rate	20 L/min at 0.1 MPa (1.0 bar, 14.5 psi)
Typical oxygen reduction rates	3 minutes to 16 % 4 minutes to 11 % 8 minutes to 6 %

10 Ordering information

10.1 Accessories

Order No. (International)	Description	Quantity
P0628-5000	CO_2 Cylinder Auto-Changeover Controller	1
P0628-5010	Two Stage CO_2 Regulator	1
P0628-5020	CO_2 Supply Line Filter	1
P0628-5030	CO_2 In-line Pressure Regulator	1
P0628-6150	Electronic CO_2 Gas Analyzer	1
P0628-6831	Electronic CO_2 and O_2 Gas Analyzer	1
P0628-5060	Autozero Filter	1
P0628-5920	Hydrophobic filter for O_2 sensor	Pack of 5
P0628-5070	Non - Perforated Shelves	1
P0628-5080	Perforated Shelves	1
P0628-5090	Lower stacking frame with castors	1
P0628-5100	Multi-position Shelf Racks (Max 6 positions)	1
P0460-7750	8-port RS-232/485 to USB converter	
P0460-7751	4-port RS-232/485 to USB converter	
P0620-7012	CO_2 incubator cable, 15 ft	
M1291-1001	BioCommand® SFI package for incubator	

For information regarding accessories not listed, contact a customer service representative.

10.2 Available options

Some option combinations are not possible, others may incur extra cost. Please inquire before ordering.

- O_2 Control, 1 – 19 %
- O_2 Control, 0.1 – 19 %
- High temperature disinfection
- Humidity alert and monitoring package
- Split inner door
- Upper stacking frame
- Lower and upper stacking frame
- Under-bench stand, 200 mm high with feet

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Declaration of Conformity

The product named below fulfills the requirements of directives and standards listed. In the case of unauthorized modifications to the product or an unintended use this declaration becomes invalid.

Product name:

Galaxy® 48 R

including accessories

Product type:

CO_2 Incubator

Relevant directives / standards:

2006/95/EC: EN 61010-1, EN 61010-2-010

2004/108/EC: EN 61326-1

2011/65/EU

Management Board

Portfolio Management

Date: November 28, 2013

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