



Galaxy[®] 48 R/48 S CO₂ Incubators

Operating manual

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1 Operating instructions

1.1 Using this manual

- ▶ Carefully read this operating manual before using the device for the first time.
- ▶ Also observe the operating manual enclosed with the accessories.
- ▶ The operating manual should be considered as part of the product and stored in a location that is easily accessible.
- ▶ When passing the device on to third parties, be sure to include this operating manual.
- ▶ If this manual is lost, please request another one. The current version can be found on our website www.eppendorf.com.

1.2 Danger symbols and danger levels

1.2.1 Hazard symbols


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

1.2.2 Degrees of danger

The following degree levels are used in safety messages throughout this manual. Acquaint yourself with each item and the potential risk if you disregard the safety message.

DANGER	<i>Will</i> lead to severe injuries or death.
WARNING	<i>May</i> 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 Product description

2.1 Main illustration

2.1.1 Galaxy 48 R/48 S CO₂ Incubators

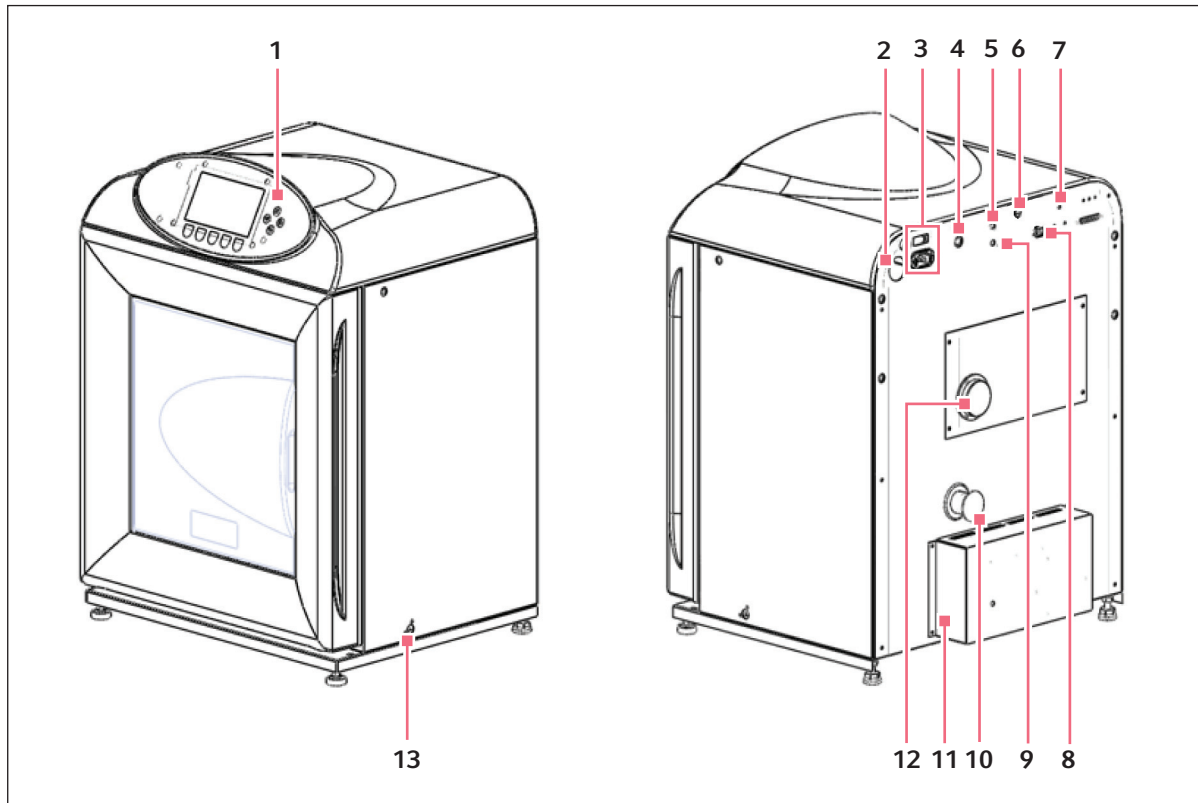
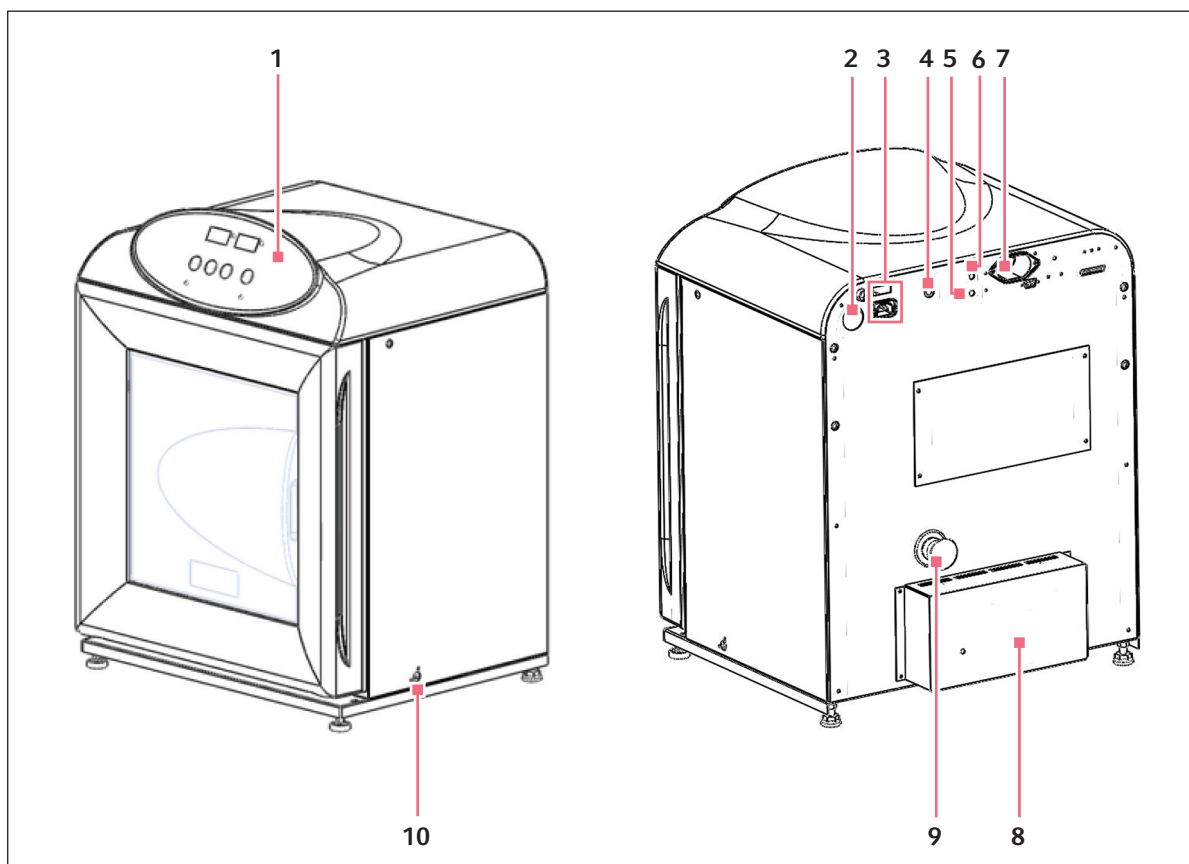


Fig. 2-1: Front and back view of the 48 R CO₂ Incubators

- | | |
|-----------------------------------|-----------------------------------|
| 1 Operating controls | 8 RS-232 connector |
| 2 Sensor cover holder | 9 N ₂ inlet (optional) |
| 3 Main/power input | 10 25 mm access port |
| 4 CO ₂ inlet | 11 Equipment tray |
| 5 O ₂ inlet (optional) | 12 O ₂ sensor port |
| 6 CO ₂ Sample port | 13 Humidity control |
| 7 Autozero filter | |

Product descriptionGalaxy® 48 R/48 S CO₂ Incubators

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Fig. 2-2: Front and back view of the 48 S CO₂ Incubators**1 Operating controls****2 Sensor cover holder****3 Main/power input****4 CO₂ inlet****5 N₂ inlet (optional)****6 Sample port****7 RS-232 connector****8 Equipment box****9 25 mm access port****10 Humidity control**

2.2 48 R control panel

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

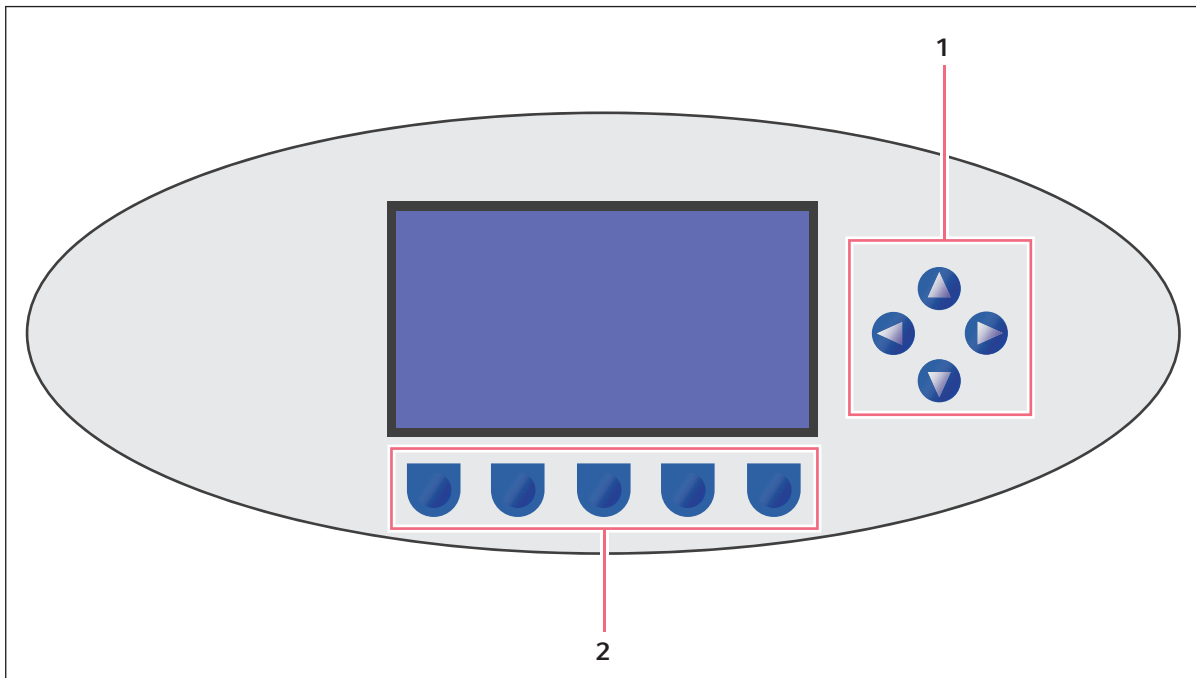


Fig. 2-3: Galaxy 48 R control panel (normal operation)

1 Directional keys

The 4 directional keys will move the cursor around the screen and adjust values

2 Function keys

The purpose of each function key is identified at the bottom of the display, above the corresponding key; the function may change from screen to screen

Product description

Galaxy® 48 R/48 S CO₂ Incubators
English (EN)

2.3 48 S control panel

The control panel consists of 2 individual 3-digit LED displays, and 4 function keys:

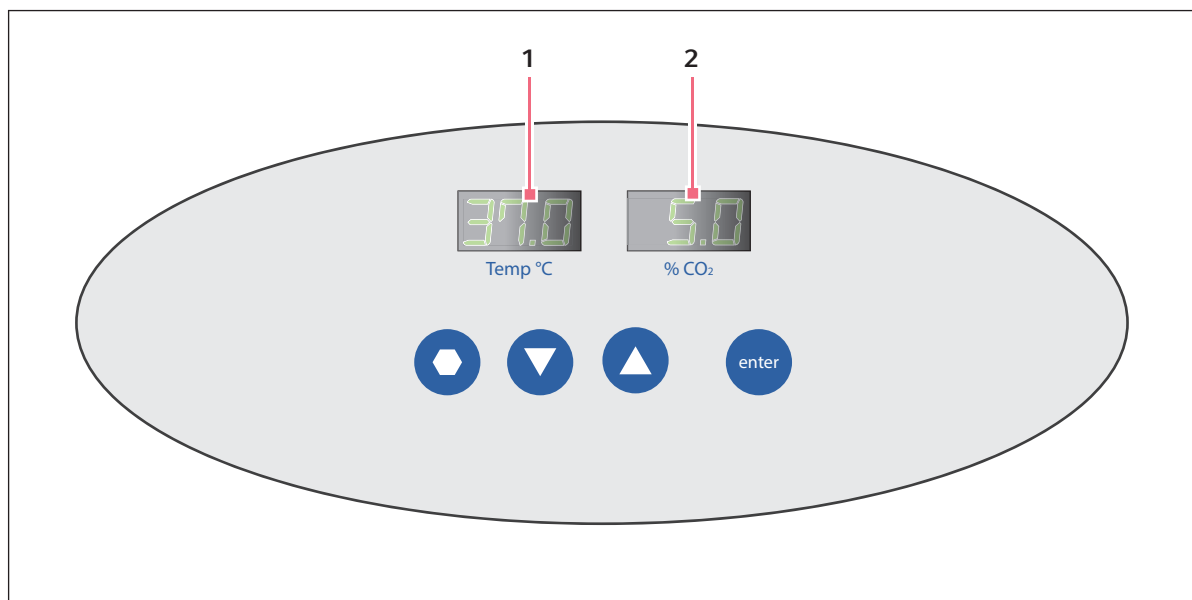


Fig. 2-4: Galaxy 48 S control panel (normal operation)

1 Temperature display

2 CO₂ display

Key Symbol	Key Name	Function
⬡	Programming	Press this key to enter Programming mode, and to set values in either display. Press this key simultaneously with the Enter key to perform autozero.
▼	Down	In Programming mode, use this key to scroll down through numbered values in the display. Press this key simultaneously with the Enter key to work in the Alarm system.
▲	Up	In Programming mode, use this key to scroll up through numbered values in the display.
enter	Enter	Press this key to save a new setpoint. Press this key simultaneously with the Programming key to perform AutoZero. Press this key simultaneously with the Down key to work in the Alarm system.



If you accidentally press both the up and down keys simultaneously, you will engage Engineering Mode: press the Programming key immediately to exit.

2.4 Accessories provided

Tab. 2-1: Accessories

Quantity	Item	Notes
3	Non-tip shelves	Installed
2	Wire shelf racks	Installed
1	Humidity tray	Packed separately
14	Silicone rubber suction feet	Installed Additional 4 spares packed in accessories bag
1	White porous CO ₂ sensor cover	Installed Additional 2 spares packed in accessories bag
1	Black sensor cover	Installed
1	Power cord	Packed in accessories bag
3 m (9.8 ft)	PVC tubing, ~ 6mm (¼ in) bore, with an inline CO ₂ HEPA-filter connected, ready for use	Packed in accessories bag
2	6 mm hoses for O ₂ 0.1 % and 1 % options	Supplied
3	6 mm hoses for O ₂ 95 % option	Supplied
2	Hose clips	Packed in accessories bag
1	AutoZero HEPA filter	Packed in accessories bag
4	Adjustable feet	Packed in accessories bag
4	Anti-slip pads for adjustable feet	Packed in accessories bag
1	User manual	Provided

2.5 Features

The Galaxy 48 R/48 S CO₂ incubator is microprocessor-controlled and designed to ensure accurate and reliable operation.

2.5.1 Operating controls

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

2.5.2 Direct heating system

A direct heating system, using 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 a 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.

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2.5.3 Infrared sensor

A solid-state infrared sensor is used to control the level of CO₂ providing excellent reliability, while remaining unaffected by humidity. The CO₂ system has a semi automatic zero system (autozero) to re-reference the sensor baseline to atmospheric CO₂ levels at regular intervals. This provides for accurate CO₂ control.

2.5.4 Controlled humidity tray

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

2.5.5 Seamless chamber

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

2.5.6 Multiple options

The Galaxy 48 R 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 CO₂ 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 above- or below-ambient oxygen levels. These and other options and accessories provide for a uniquely flexible CO₂ incubator capable of meeting the most demanding requirements.

2.6 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.

3 Safety

3.1 Intended use

Eppendorf CO₂ 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(es) 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.
-

3.2 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.

3.3 Application limits

3.3.1 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.

3.4 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 succeeding 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.

3.5 Warnings for intended use

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

3.5.1 Personal injury and damage to device



WARNING! Risk of personal injury

- ▶ Elevated levels of CO₂ may be found in and around the operating area of the CO₂ incubator.
- ▶ Wear personal protective equipment (PPE).

**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.



CAUTION! Risk of personal injury

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



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**

- ▶ To avoid possible damage to the CO₂ 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.



NOTICE! Risk of material damage

- ▶ CO₂ gas pressure must not exceed 5 PSI (0.35 bar) unless operating with N₂ or O₂.



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 (see also "Using Powered Equipment within the Chamber"). If in doubt, consult with the manufacturer of the equipment.
 - ▶ Always ensure the connections are properly and securely made.
 - ▶ Be sure to switch OFF the green illuminated switch on the front left of the IP66 enclosure before connecting or disconnecting equipment inside the chamber.
 - ▶ The Sealing Cap must always be in place when the socket is not in use.
 - ▶ Both the incubator and the IP66 enclosure must be plugged into an electrical supply protected by an RCD device. Any device chosen must be a self-resetting type which will automatically reconnect power to the incubator as soon as power is restored following a power failure.
-

Safety

Galaxy® 48 R/48 S CO₂ Incubators
English (EN)

4 Installation

4.1 Utilities requirements

The following utility requirements are needed to operate the incubator:

Tab. 4-1: Utility requirements

Utility	Requirement
Electricity	120 V, 50/60 Hz grounded electrical supply with minimum capacity of 6 A (8 A for high temperature disinfection models)
	230 V, 50/60 Hz grounded electrical supply with minimum capacity of 3 A (or 5 A for high temperature disinfection models)
CO ₂ gas	Cylinder with 100 % CO ₂ vapor withdrawal, together with a two-stage regulator and an in-line pressure regulator for pressure control to 5 PSI (0.35 bar), (see <i>Accessories on p. 77</i>).



NOTICE! Risk of material damage

- ▶ CO₂ gas pressure must not exceed 5 PSI (0.35 bar) unless operating with N₂ or O₂.

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 if the incubator is being operated at 37 °C.

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

Installation

Galaxy® 48 R/48 S CO₂ Incubators
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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.

Perform the following steps to install the adjustable feet:

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



Keep anti-slip pads installed at all times.

4.3.2 Setting up

1. Install the power cord by inserting it into its receptacle on the back of the incubator and pressing it firmly into its socket.
Connect the CO₂ gas supply (see *Connect the CO₂ gas supply on p. 20*).

4.3.3 Connect the CO₂ gas supply

Perform the following steps to connect the CO₂ gas supply:

**WARNING! Risk of personal injury**

- ▶ Elevated levels of CO₂ may be found in and around the operating area of the CO₂ incubator.
- ▶ Wear personal protective equipment (PPE).

1. Connect the incubator to the CO₂ supply using the ~ 6 mm (1/4 in) plastic tubing (with installed filter) by attaching the tubing from the 2-stage regulator (or in-line regulator) to the matching CO₂ inlet on the rear of the incubator.



It is highly recommended that an in-line regulator be used at the incubator's gas inlet(s). For proper incubator operation, CO₂ gas pressure must not exceed 5 PSI (0.35 bar).

2. Use the tubing clips provided to eliminate CO₂ leaks.

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

The shelf racks and shelves are pre-installed. Perform the following steps if replacement is required.

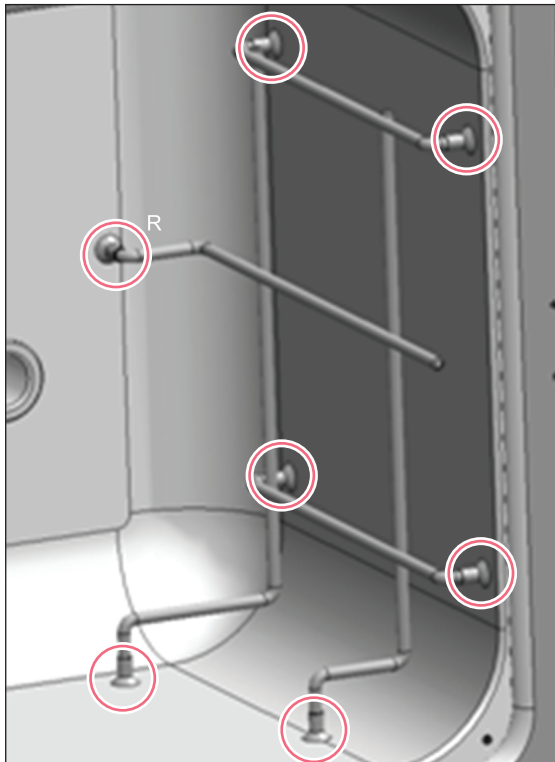


Fig. 4-1: Wire shelf rack

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 ("Rear") goes to the rear of the chamber. The suction cups will adhere to the chamber walls even if they are dry; but if you feel it is necessary, you can dampen them with distilled water to increase adhesion.

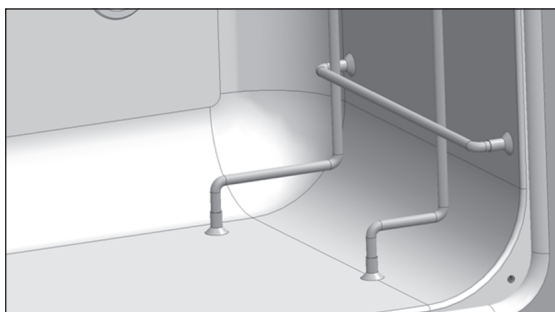


Fig. 4-2: Suction cup

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

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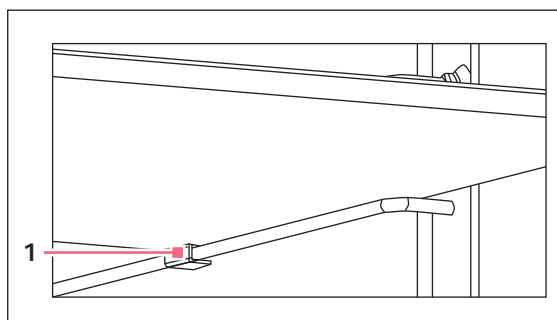


Fig. 4-3: Shelf rack

1 Anti-tip tab

4.3.5 Replacing the humidity tray

The humidity tray is pre-installed. Perform the following steps if replacement is required:

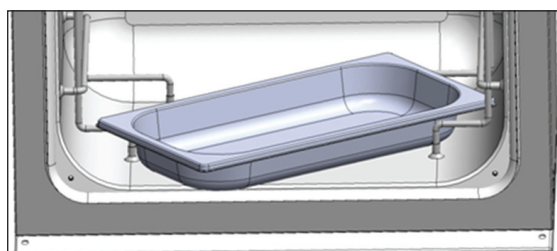


Fig. 4-4: Humidity tray

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. 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.

1. Install the humidity tray in its location beneath the lowest shelf rack position: insert the tray diagonally, then turn the tray 45° as shown, until you can set it in position.

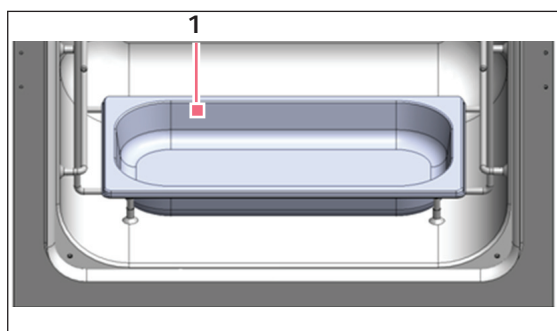


Fig. 4-5: Humidity tray

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

1 Tray installed on 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 - Galaxy 48 R

5.1 Preparing for operation

1. Remove the black protective cover from the CO₂ sensor, taking care not to remove the white porous cover.
Store the black cover on the sensor cover holder on the back of the incubator. The sensor cap should be placed back on the sensor when the incubator is to be cleaned.
2. Ensure that the white porous sensor cover remains in place.
3. Using the mains/power cord provided, connect the incubator to a earthed/grounded mains/power supply.
4. Switch the incubator ON using the on/off switch at the rear of the cabinet.
The display will illuminate immediately.
5. Turn on the CO₂ gas supply with the pressure regulator set to 5 PSI (0.35 bar) unless operating with N₂ or O₂.
6. The chamber setpoints are pre-programmed at 37.0 °C and 5 % CO₂. Leave the incubator on until the programmed chamber temperature and CO₂ concentration have been reached.
 -  • The incubator's CO₂ valve is disabled until the incubator reaches the temperature setpoint. After the temperature setpoint is reached, the CO₂ valve is activated, allowing the incubator to reach the CO₂ setpoint.
 - If power is interrupted to the incubator long enough for the temperature to drop below setpoint, the CO₂ valve will be deactivated until temperature setpoint is again achieved. (This serves to avoid spurious CO₂ readings while the incubator is below its temperature setpoint)
7. 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 CO₂ 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 will cause corrosion inside the incubator.

If humidification is required:

1. Fill the humidity tray with 0.5 liters of warm (~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 (~0.11 oz or 3.6 g) of copper sulphate to the water in the humidity tray.
3. To reduce the possibility of contamination, every 10 to 14 days, empty the tray, clean it with a solution of 70 % isopropyl alcohol and 30 % distilled water, and then refill it with 0.5 liters of warm distilled water.



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

5.3 Programming

5.3.1 Programming CO₂, O₂ and temperature

Perform the following steps to set the desired operating temperature, O₂ and CO₂ level.

1. Press the *PROG* function key.
2. In the *PROG* screen that appears, press the desired function key, *TEMP*, *O₂* or *CO₂*, 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 CO₂ 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 O₂ level programmed between 0.1 - 0.9 %, you should know that the control system is set to operate in the following way to minimize N₂ consumption after the glass door has been opened:

- The N₂ valve is switched on continuously until the O₂ level is within 0.1 % of setpoint.
- The CO₂ valve is then switched on to allow the CO₂ level to reach setpoint. If the O₂ level is above setpoint 15 minutes after the N₂ valve has been switched off, it is switched back on for 40 seconds and the CO₂ valve is switched on for 20 seconds. The CO₂ valve will then pulse until setpoint is reached.
- The process described above will repeat itself until the O₂ setpoint is reached.
- The same process will also repeat if the O₂ level rises above setpoint, and if the O₂ level should rise toward 0.2 % above setpoint, the N₂ valve will open again continuously until the O₂ level returns to setpoint.
- The CO₂ autozero, which would normally take place after a CO₂ alarm, will be cancelled to avoid the introduction of additional O₂ into the chamber. For the same reason, we recommend canceling the programmed CO₂ 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 CO₂ sensor with autozero

Prior to using the incubator, you should manually perform a CO₂ autozero:

1. Perform a CO₂ autozero by pressing the *USER* function key (see *48 R control panel on p. 11*), selecting *PROGRAMMABLE CO₂ 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* screen, you can adjust the features called out on the screen.

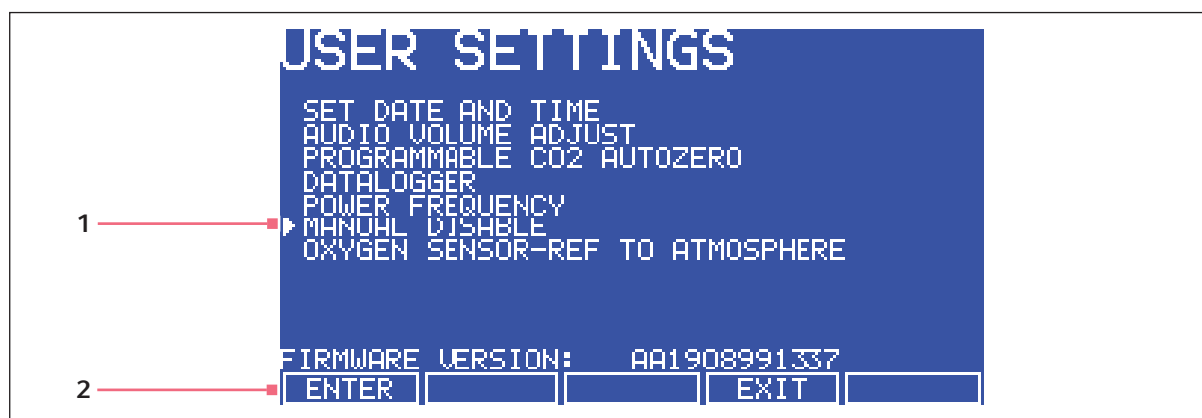


Fig. 5-1: *USER SETTINGS* screen

- 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 CO₂ AUTOZERO*

When you select this feature, the *PROGRAM CO₂ AUTOZERO* screen (see Fig. 5-2 on p. 27) allows you to program the autozero frequency and time, or to run the autozero function manually.

We recommend that you autozero the CO₂ system:

- Prior to using the incubator for the first time.
- Once a month when your incubator is operating, to ensure that the CO₂ 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 CO₂ sensor to atmospheric CO₂ 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.

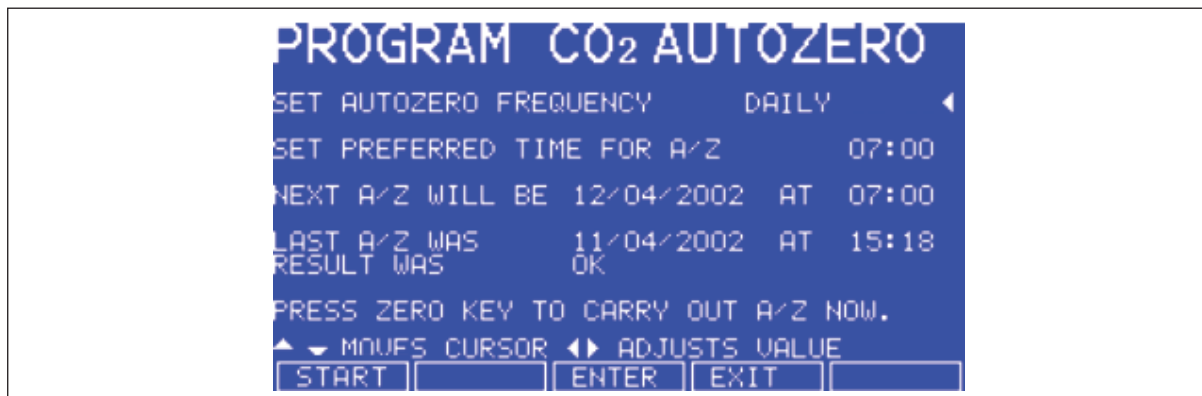


Fig. 5-2: PROGRAM CO₂ AUTOZERO screen



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

2. At the end of the two minutes, the control system adjusts the autozero Factor to reference the sensor to 0.05 % CO₂, 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 CO₂ 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. 28).

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 CO₂ AUTOZERO* window.

5.5.4 DATALOGGER

For detailed information (see *DATALOGGER screen* on p. 29).

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 *CO₂ PRESSURE SWITCH* (for autozeroing). Additional Disable Options appear on this screen according to the options installed on your incubator.

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 O₂ sensor is removed before running high temperature disinfection.
-

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 O₂ 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. 36).

5.6 *DATALOGGER* screen

The *DATALOGGER* screen displays the following information:

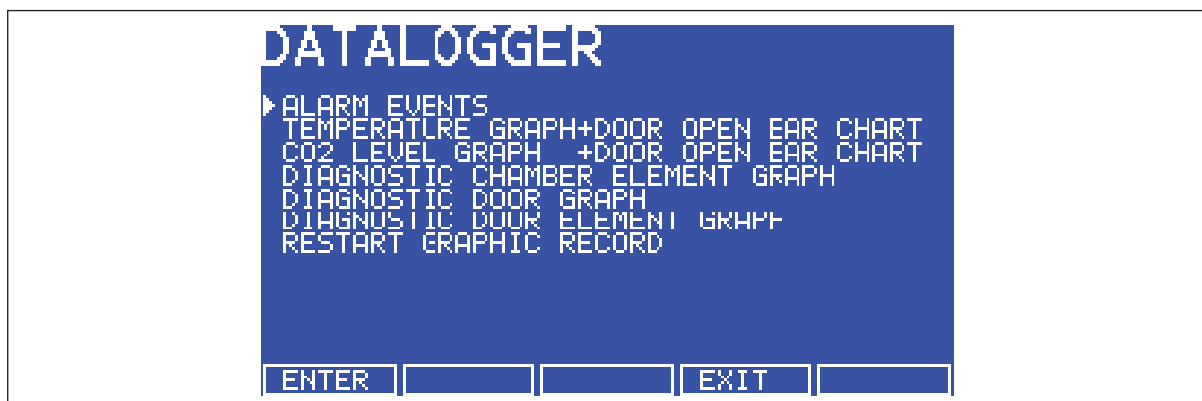


Fig. 5-3: *DATALOGGER* screen

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)
- CO₂ level high/low (programmed value)
- CO₂ supply failure
- All system alarms
- CO₂ 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. 30):

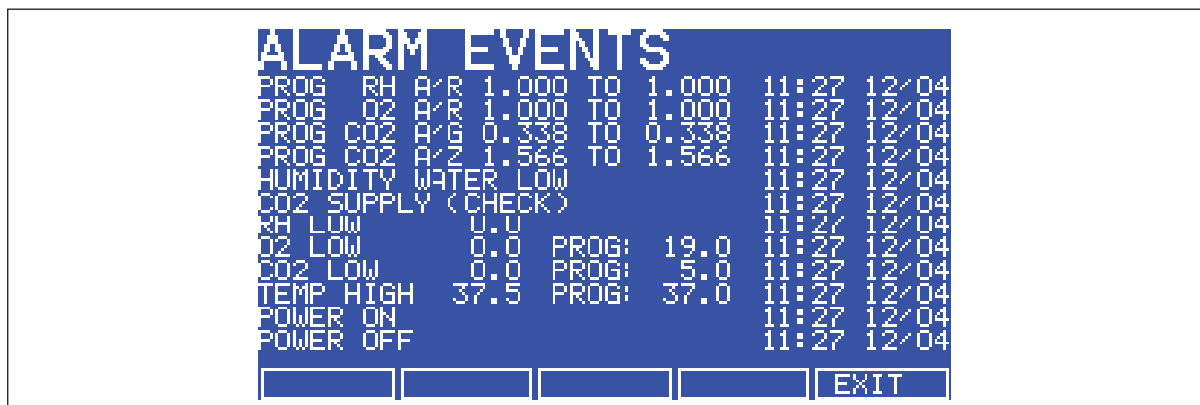


Fig. 5-4: ALARM EVENTS screen

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. 31). 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 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. 31).

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

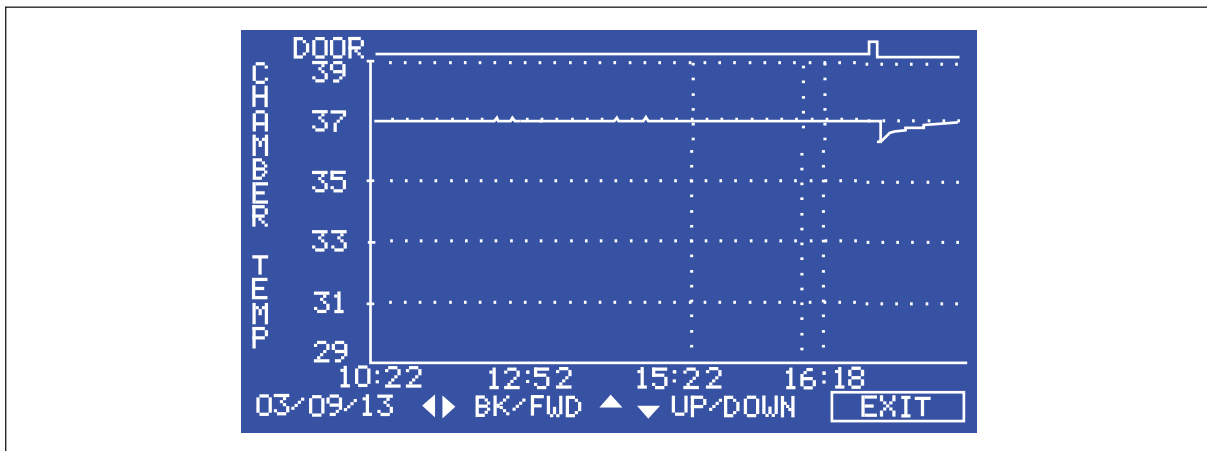


Fig. 5-5: TEMPERATURE GRAPH + DOOR OPEN BAR CHART screen

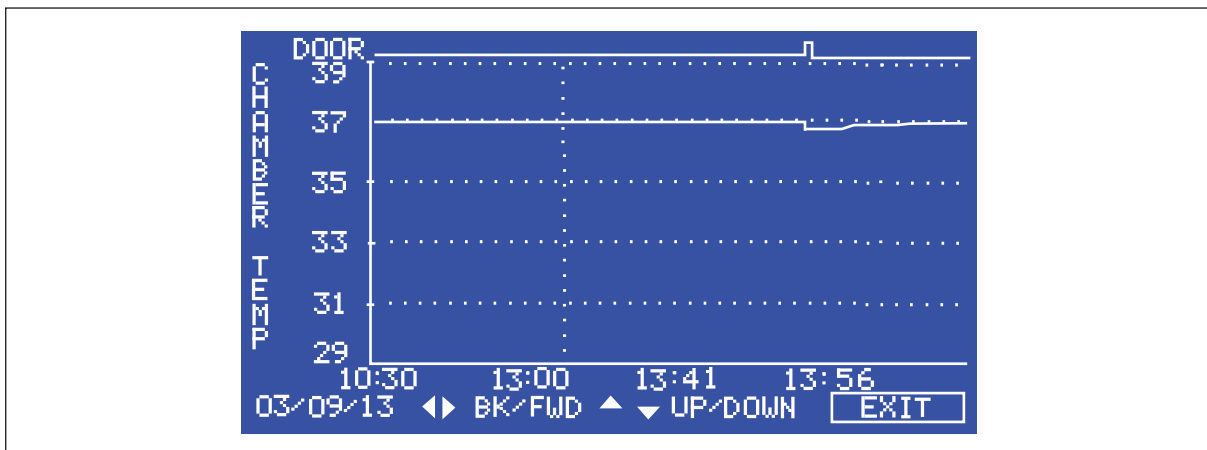


Fig. 5-6: Dotted vertical line showing compressed/decompressed data.

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 *RS-232 interface* on p. 51).

5.6.3 CO₂ GRAPH + DOOR OPEN BAR CHART

These graphs record in a way similar to the chamber temperature graphs. The specification for CO₂ is $\pm 0.1\%$.



Both CO₂ 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* menu screen

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. 32) 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 CO₂ High and Low Alarm setpoints automatically adjust to within ± 0.5 of the temperature and CO₂ setpoints. The alarm setpoints can also be manually adjusted.

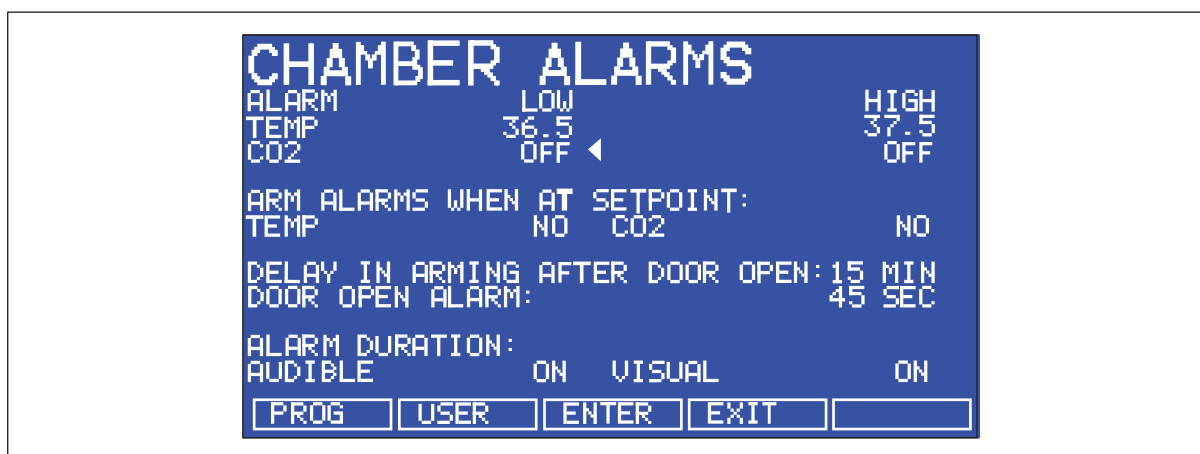


Fig. 5-7: *CHAMBER ALARMS* screen

To arm the chamber alarms after a selectable delay:

1. Choose the option *ARM ALARMS WHEN AT SETPOINT*.
2. Select *NO* for both *TEMP* and *CO₂* (see Fig. 5-7 on p. 32).

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. 32)) to allow for temperature and CO₂ recovery after the door has been opened.

Alternatively, the alarm system can be set to re-arm only after the original temperature and CO₂ setpoints have been achieved:

1. Choose the option *ARM ALARMS WHEN AT SETPOINT*.
2. Select *YES* for both *TEMP* and *CO₂*.

When *YES* is selected for this function, the *DELAY IN ARMING AFTER DOOR OPEN* is ignored.

A *DOOR OPEN ALARM*: can be adjusted, choosing from seven preset durations (45 seconds in (Fig. 5-7 on p. 32)) to warn of an improperly closed door.

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 seven 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. 5-8 on p. 33).

5.7.1 Chamber alarm system function

When the incubator is switched *ON*, or after the temperature and CO₂ 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. CO₂ and temperature alarms are individually armed.

If temperature and/or CO₂ 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. 33). Acknowledge the alarm by pressing any key.

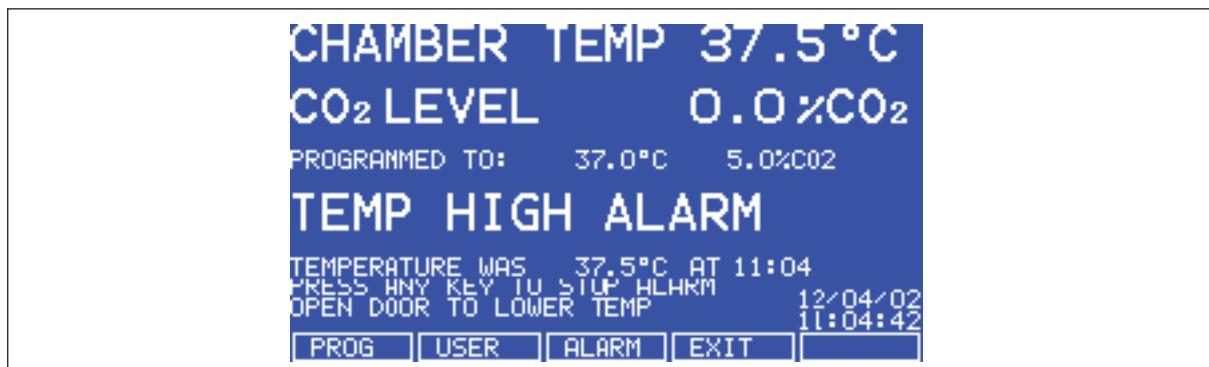


Fig. 5-8: *CHAMBER ALARM* message

After setpoints have been achieved for the first time, when the outer door is opened, the alarm system is disabled; on closing the door, if selected, a programmable alarm delay starts:

- 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 CO₂ 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 CO₂ valve is opened and no pressure is detected, an alarm occurs and a warning message appears on the screen, alerting you to *CHECK CO₂ SUPPLY* (see Fig. 5-9 on p. 34).

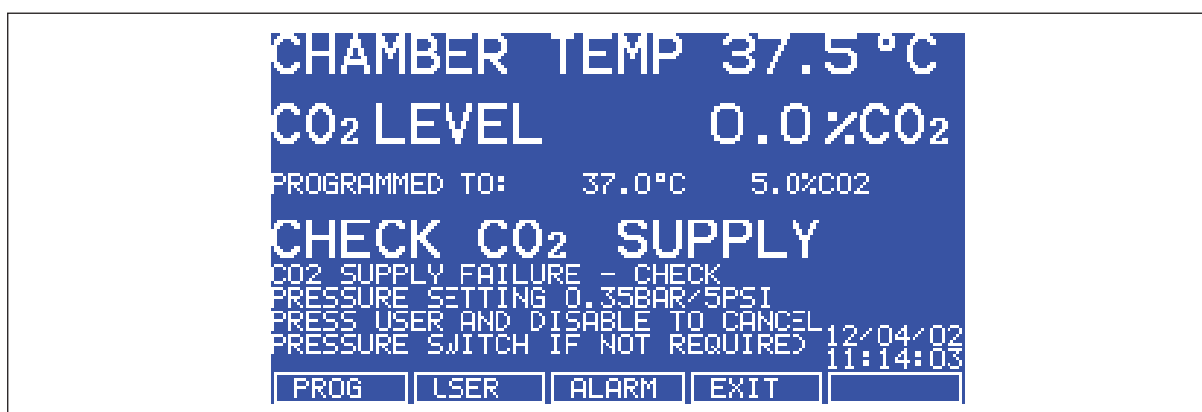


Fig. 5-9: *CHAMBER ALARM* to check CO₂ supply

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



The alarm levels are set automatically to ± 0.5 % above and below the programmed value, but these points can be altered in the *ALARM* screen. In addition, the re-arming of the alarm can be delayed until the Programmed Value is achieved by selecting the relevant option in the *ALARM* screen.

For example, it is possible at low oxygen levels that the CO₂ and O₂ levels might not fully recover within the Alarm Limits after the 15-minute *DELAY IN ARMING AFTER DOOR OPENING* period has elapsed, so this time period can be increased in the *ALARM* screen to suit individual circumstances.

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.

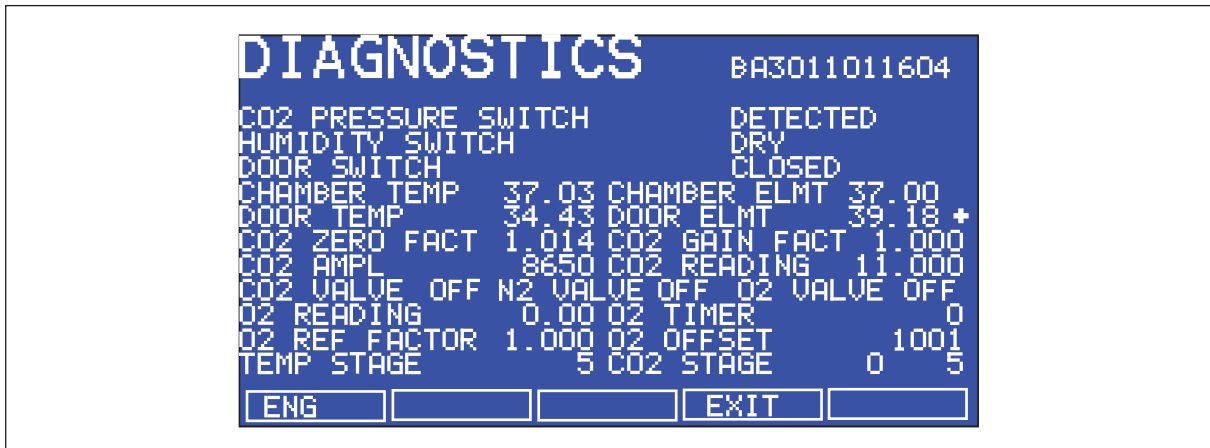


Fig. 5-10: *DIAGNOSTICS* screen

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 CO₂ incubator and its functions can always be found on-screen.

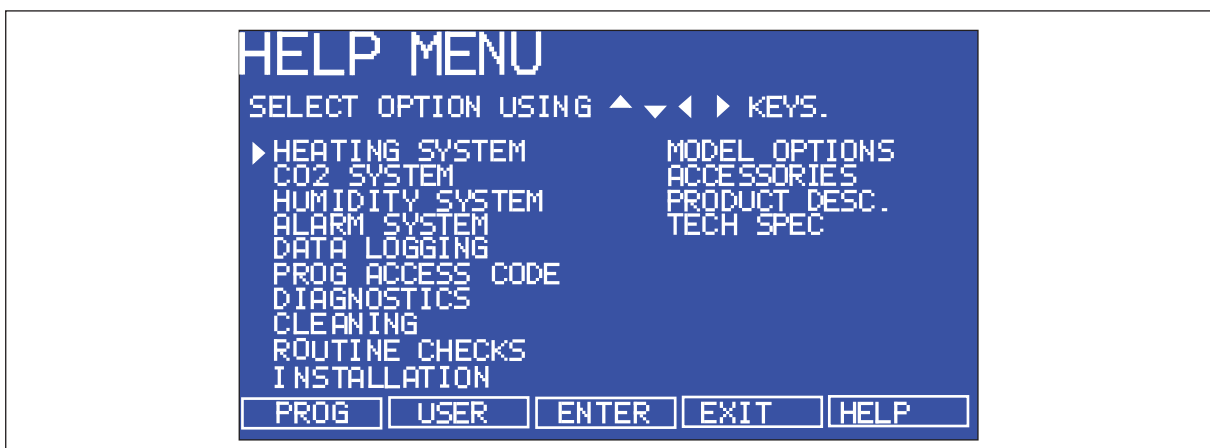


Fig. 5-11: *HELP MENU* Screen

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. 38*).

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. 68*).
- 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 CO₂ 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.

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 O₂ SENSOR REMOVED?* Ensure that the O₂ 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 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 door and inner door seal surface temperatures will be $\pm 5^\circ$ 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. 37) and (see Tab. on p. 37). 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 CO₂ 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 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. 38*).

5.11 Oxygen sensor removal

Prior to beginning a disinfection cycle, remove the oxygen sensor. For detailed instructions, (see *Removing and replacing O₂ sensor on p. 47*).

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
- CO₂ high
- CO₂ 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. 39) for location. The matching plug is provided, when the option is installed.

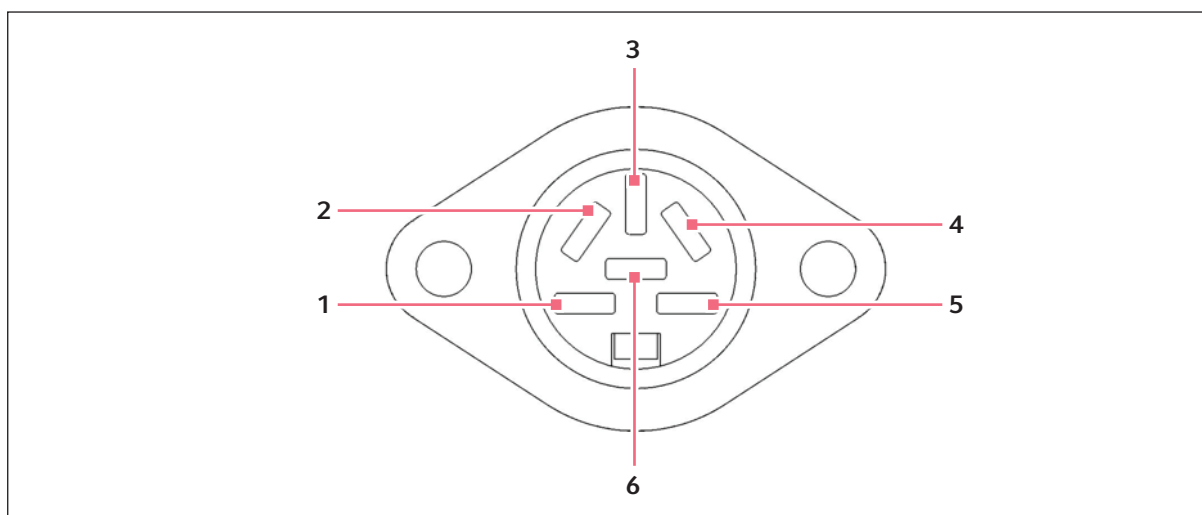


Fig. 5-12: BMS relay contact alarm socket

Pin	Designation	
1	48R: 24 V DC unregulated	To power external equipment such as a remote buzzer or light (100 mA maximum current available).*
	48S: 12 V DC	
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*.

To enable or disable BMS on the Galaxy 48S model, simply go to the Engineering menu, scroll down to *RELAY*, then press *ENTER*. Using the up / down arrow keys, choose either *YES* or *NO*.

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 *MAKE ALARM RELAY ACTIVE AT POWER SWITCH OFF/FAILURE YES/NO*.
4. Toggle to *NO* and then press *ENTER*.

5.13 O₂ control

5.13.1 Setting up the N₂ tank

Before setting up O₂ control, ensure that you have the proper equipment for your nitrogen supply:

- 2 cylinders of nitrogen, regulation size W
- (1) 2-stage pressure regulator
- 1 inline tubing pressure regulator
- 6 mm PVC tubing
- 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. Place the inline pressure regulator close to the incubator.
4. Securely attach the two-stage pressure regulator to the nitrogen tank's outlet and to the inline pressure regulator's inlet with tubing, securing both ends with clips.
5. Connect the inline pressure regulator's outlet to the incubator's N₂ inlet on the right side of the control box at the rear of the incubator; secure both ends with clips.
6. Set up oxygen control based on your option: 1 – 19 %, 0.1 – 19 %, or 1 – 95 %.

5.13.2 Setting up oxygen control (0.1 – 19 %)

Oxygen control is tailored such that both the O₂ and the CO₂ levels are achieved at approximately the same time, via control of the N₂ valve's duty cycle (but within the range of 0.1 – 19 % O₂)

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 N₂ tank's outlet pressure gauge to 1.5 bar.
3. Set the nitrogen regulator to 7 PSI (0.5 bar). The gas flow rate is approximately 20 liters/minute.



When working at high O₂ levels approx > 90 %, you may adjust the O₂ pressure up to 10 PSI (0.7 bar).



- If the programmed O₂ 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 % O₂, set the CO₂ pressure to 10 PSI (0.7 bar).

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. If you have the 0.1 – 19 % oxygen control option, (see *Setting up oxygen control (0.1 – 19 %)* on p. 41). If you have the 1 – 95 % oxygen control option, (see *Setting up oxygen control (1 – 95 %)* on p. 43).

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 N₂ tank's outlet pressure gauge to 1.5 bar
3. Set the nitrogen regulator to 14.5 PSI (1 bar). The gas flow rate is approximately 20 liters/minute.



If the programmed O₂ 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.

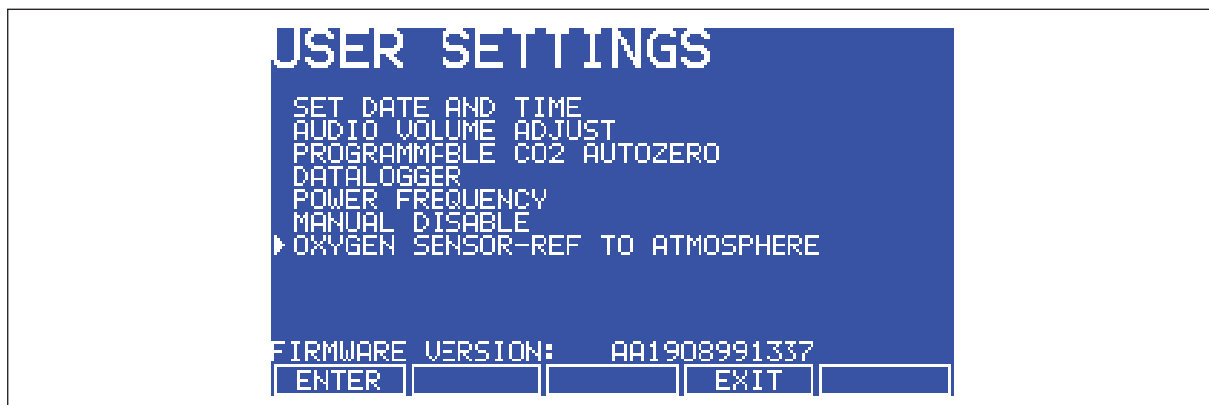


Fig. 5-13: Selecting *OXYGEN SENSOR-REF TO ATMOSPHERE*

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

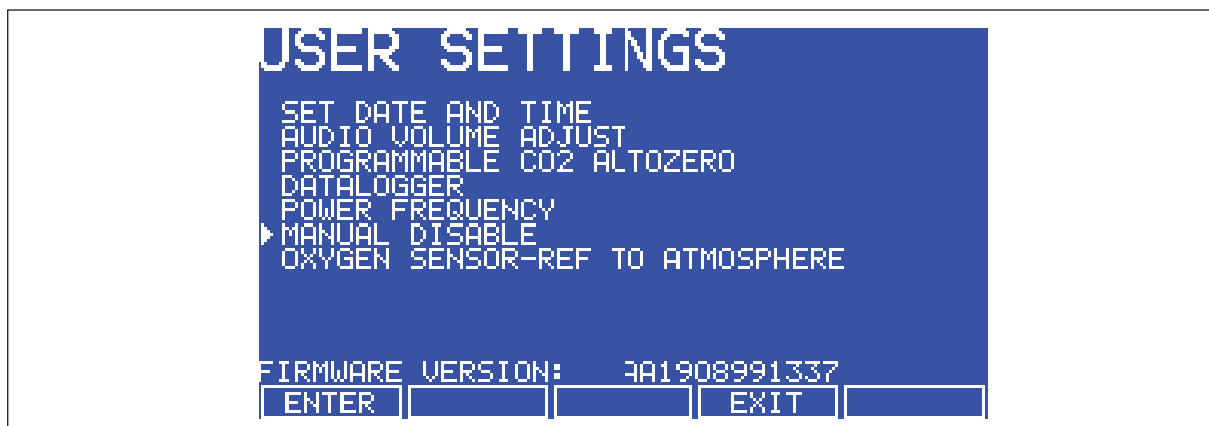


Fig. 5-14: *USER SETTINGS* screen

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 CO₂ and O₂ 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 N₂ 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 (see *Referencing to atmosphere* on p. 45) Step 3, 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 CO₂ 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.

5.13.4 Setting up oxygen control (1 – 95 %)

This option uses the controlled addition of oxygen to increase the level above ambient and the controlled addition of nitrogen to reduce the oxygen level below ambient. If you have the 1 – 19 % control option, . If you have the 0.1 – 19 % control option, .



WARNING! Risk of personal injury

High oxygen levels inside the chamber require additional safety precautions:

- ▶ Setting the oxygen to levels > 24 % can greatly increase the chance of fire and explosion. Operators planning to set oxygen at 24 – 95 % should therefore take all appropriate precautions to minimize the risk. Eppendorf does not recommend using external (heat-generating) equipment inside the chamber when oxygen conditions will be > 24 %.
- ▶ Before opening the incubator door, make sure no flames (Bunsen burner, etc.) are in the vicinity.
- ▶ Avoid the presence of other combustible gases (hydrogen, methane, etc.)
- ▶ Ensure that all solenoid valves and pressure regulators and gauges controlling the gas supply are grease-free for use with oxygen.

If your incubator is operating in the 3 – 95 % range of O₂ control, only the N₂ valve will operate for setpoints below 19 %; both the N₂ and O₂ valves will operate for setpoints between 19 and 80 %; and for setpoints above 80 %, only the O₂ valve will operate.



If you plan to maintain O₂ levels of 80 – 95 %, please read the important notes at the end of the following procedure.

Oxygen control is tailored such that both the O₂ and the CO₂ levels are achieved at approximately the same time, via control of the O₂ or N₂ valve's duty cycle.

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 N₂ tank's outlet pressure gauge to 22 PSI (1.5 bar).
3. Set the nitrogen regulator to 7 PSI (0.5 bar). The nitrogen will be fed into the incubator through a filter that is already installed in the gas line. The gas flow rate is approximately 20 liters/minute.



If the programmed O₂ 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. Install the oxygen cylinder in the same manner as outlined for the nitrogen cylinder installation (see *Setting up the N₂ tank on p. 40*), using the incubator's O₂ inlet, of course. For this application, you will need another two-stage pressure regulator and another inline pressure regulator.



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.



CO₂ regulator should be set to 7 PSI (0.5 bar) if O₂ is set at or above ambient (i.e. approximately 19%) in a humidified atmosphere, 5 PSI (0.35 bar) if at levels below ambient.



If you are running the incubator with a dry chamber and no CO₂, the recommended maximum O₂ level is 95 %. In addition, open samples inside the chamber can cause RH to increase, and the O₂ sensor may require recalibration to work properly in a completely dry atmosphere. For a humidified chamber with no CO₂, the recommended maximum O₂ level is 92 %, while for a humidified chamber with 5 % CO₂, we recommend no more than 87 % O₂. When the incubator is running at normal humidity level (i.e., 95 % RH), there is approximately 6 % (by volume) water vapor present in the chamber. If 5 % CO₂ is also present, the maximum achievable level of O₂—without using excessive quantities of oxygen—is approximately 87 %. Oxygen direct from a cylinder has a dewpoint temperature of <-45°C, corresponding to 0.06 % water vapor. As it enters the incubator, therefore, its temperature is very low and even as it is warmed, its RH level is very low. Both of these factors affect the performance of the O₂ detector. To minimize these effects, O₂ is fed continuously until it arrives at 0.4 % below setpoint. To allow the detector signal to recover and the RH level to build, there is a 3-minute delay. If O₂ is still required, it is fed in for 10 seconds, with an additional 3-minute delay until setpoint is achieved. As the humidity level rises, the O₂ content in the chamber will diminish. The use of O₂ will rise considerably as the setpoint approaches the sum contents of water vapor and CO₂ in the chamber. In the short term, it is possible to achieve higher levels of O₂, but as humidity rises and O₂ content is pushed down, there will be a continuous demand for O₂ and RH will remain too low. At the same time, as O₂ is pumped in, the CO₂ level will also diminish, causing the system to add CO₂, which in turn causes the O₂ level to drop again. If the O₂ setpoint is too high, the incubator can consume some 2,500 liters of O₂ per day—which does not include the extra oxygen consumed each time the door is opened (about 500 liters).

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. 46*).
The sensor needs to be replaced immediately (see *Replace sensor now on p. 46*).

5.15 Oxygen sensor replacement

If you complete a referencing procedure and the O₂ sensor is not functioning at 100%, you will receive 1 of 2 messages: *O₂ REFERENCE OK BUT SENSOR REQUIRES REPLACEMENT SHORTLY* (see *Replace sensor soon* on p. 46), or *O₂ REFERENCE FAILED* (see *Replace sensor now* on p. 46) 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:

O₂ REFERENCE OK BUT SENSOR REQUIRES REPLACEMENT SHORTLY

PRESS ENTER TO PROCEED

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

O₂ SENSOR

THE RESULT OF THE O₂ REFERENCE PROCESS SHOWS THAT THE SIGNAL FROM THE O₂ 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:

O₂ REFERENCE FAILED

PRESS ENTER TO PROCEED

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

O₂ SENSOR

THE RESULT OF THE O₂ REFERENCE PROCESS SHOWS THAT THE SIGNAL FROM THE O₂ 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:

O₂ 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 O₂ sensor

Prerequisites

- Oxygen sensor removal tool (see Fig. 5-16 on p. 48)



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. 48).

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

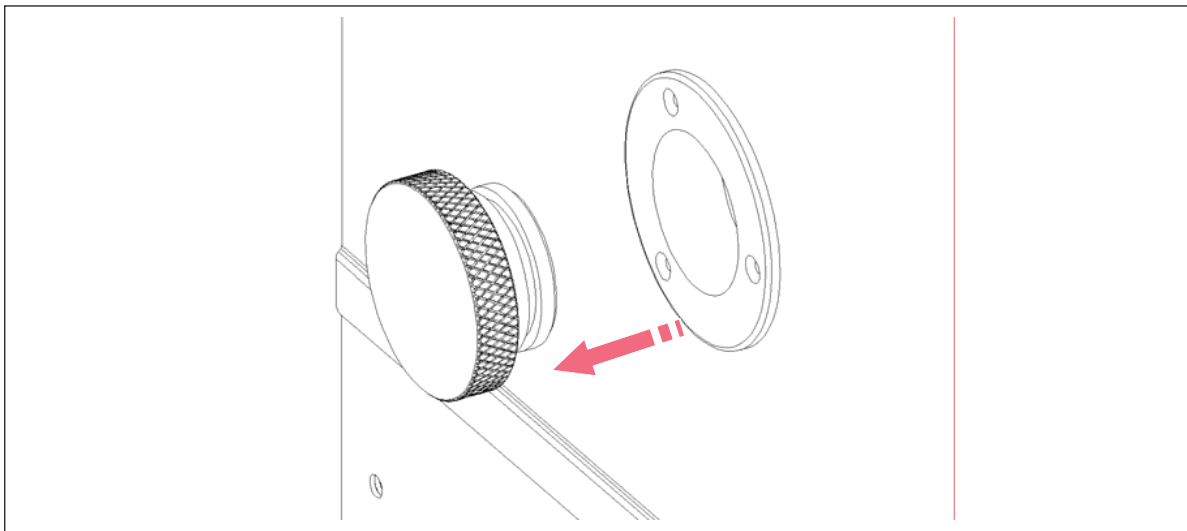


Fig. 5-15: Oxygen sensor rear access cover

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. 48), 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.
4. 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.

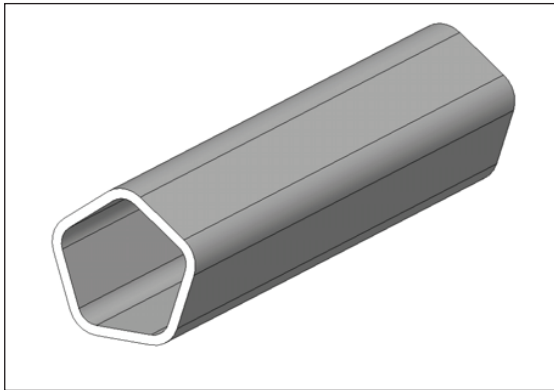


Fig. 5-16: Oxygen sensor removal tool

5. Reconnect the sensor by plugging the white connector body back in.
6. 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.
7. After replacing the sensor, humidify the incubator and allow it to stabilize overnight.
8. Calibrate the sensor with reference to the atmospheric oxygen level (see *Referencing to atmosphere on p. 45*).

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.

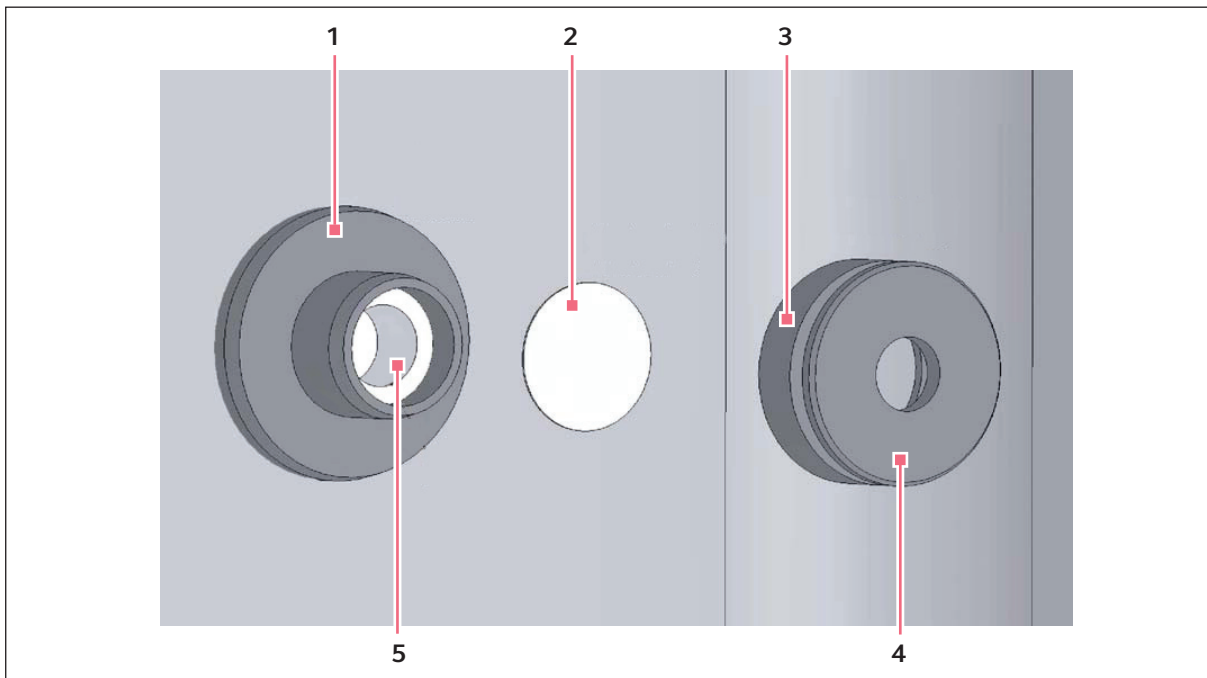


Fig. 5-17: Hydrophobic filter and holder assembly (exploded view)

- | | |
|-----------------------------|--------------------------|
| 1 Oxygen sensor holder | 4 Hydrophobic filter cap |
| 2 Hydrophobic filter disc | 5 Oxygen sensor |
| 3 Hydrophobic filter holder | |

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 bottom surface of the incubator is heated to over 150 °C during the decontamination cycle which may affect the sensor or the cable if left in contact with the bottom of the incubator.

- ▶ Never leave the humidity warning sensor on the bottom surface of the incubator during a high temperature decontamination cycle. Place it on the shelf above the humidity tray and ensure that the cable is not resting on the base of the incubator chamber.

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 CO₂ 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 (see *Main illustration on p. 9*).
- 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 (see *Main illustration on p. 9*).
- Suitable communications software, such as New Brunswick 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:

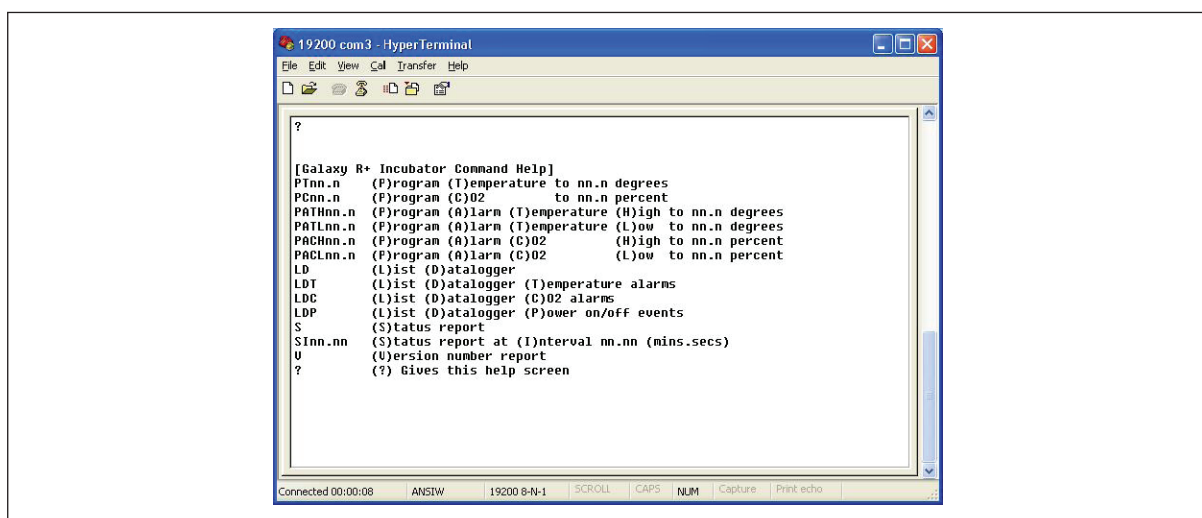
1. Connect the null-modem cable to the RS-232 port at the rear of the incubator.
2. Connect the other end of the cable to either the 25-pin male D serial com port or the 9-pin male D serial com port on the PC or terminal.
3. Turn on the computer and start the communications software.

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4. Select an unused serial port to enable communications between the incubator and the PC or terminal. If you know which port to use, continue to Step 5 and then skip to Step 7. If not, continue to Steps 5 and 6.
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, CO₂ and alarm setpoints to be programmed remotely. A running status report can be generated at user-defined intervals, and all reports can be sent to a printer. For details on these features, consult the documentation supplied with your communications software.

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

Tab. 5-4: Remote programming

PTnn.n	(P)rogram new (T)emperature setpoint. Type <i>PT37.5</i> , then press <i>ENTER</i> to reprogram the incubator's temperature setpoint to 37.5 °C.
PCnn.n	(P)rogram new (C)O ₂ level. Type <i>PC04.0</i> , then press <i>ENTER</i> to reprogram the incubator's CO ₂ level to 4 %.
PATHnn.n	(P)rogram new (A)larm (T)emperature (H)igh setpoint. Type <i>PATH38.0</i> , then press <i>ENTER</i> 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 <i>PATL36.0</i> , then press <i>ENTER</i> 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 <i>PACH05.5</i> , then press <i>ENTER</i> 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 <i>PACL04.5</i> , then press <i>ENTER</i> 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 <i>S</i> , then press the <i>ENTER</i> key to display a current status report, which may look like this: <i>Temperature: Actual 37.0 °C Setpoint 37.0 °C</i> <i>CO₂: Actual 05.0 % Setpoint 05.0 %</i>
SInn.nn	(S)tatus report at (I)nterval of n minutes, n seconds. Type <i>SI60.0</i> , then press the <i>ENTER</i> key to display a current status report (as shown above) every hour. A confirmation message will appear: <i>Status report at interval 60.0 will be given</i> <i>Press "Enter" or "ESC" to stop reports</i>

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 <i>V</i> , then press the <i>ENTER</i> key to generate a report on the current firmware version.
?	Type <i>?</i> , then press the <i>ENTER</i> 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	<i>TEMPERATURE LOW</i>
Alarm	<i>TEMPERATURE HIGH</i>
Alarm	<i>CO₂ LOW</i>
Alarm	<i>CO₂ HIGH</i>
Alarm	<i>TEMPERATURE SENSOR FAILURE</i>
Alarm (AutoZero)	<i>PROG CO₂ A/Z SYSTEM INOPERATIVE</i>
AutoZero Event	<i>PROG CO₂ A/Z COMPLETED OK</i>
Door Event	<i>DOOR OPENED</i>
Door Event	<i>DOOR CLOSED</i>

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


[DOOR EVENT] DOOR OPENED

Temperature: Actual 37.0 °C Setpoint 37.0 °C

CO₂: Actual 00.1 % Setpoint 05.0 %

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6.1 Preparing for operation

1. Remove the black protective cover from the CO₂ sensor, taking care not to remove the white porous cover.
Store the black cover on the sensor cover holder on the back of the incubator . The sensor cap should be placed back on the sensor when the incubator is to be cleaned.
2. Ensure that the white porous sensor cover remains in place.
3. Using the mains/power cord provided, connect the incubator to a earthed/grounded mains/power supply.
4. Switch the incubator ON using the on/off switch at the rear of the cabinet.
The display will illuminate immediately.
5. Turn on the CO₂ gas supply with the pressure regulator set to 5 PSI (0.35 bar) unless operating with N₂ or O₂.
6. The chamber setpoints are pre-programmed at 37.0 °C and 5 % CO₂. Leave the incubator on until the programmed chamber temperature and CO₂ concentration have been reached.
 -  • The incubator's CO₂ valve is disabled until the incubator reaches the temperature setpoint. After the temperature setpoint is reached, the CO₂ valve is activated, allowing the incubator to reach the CO₂ setpoint.
 - If power is interrupted to the incubator long enough for the temperature to drop below setpoint, the CO₂ valve will be deactivated until temperature setpoint is again achieved. (This serves to avoid spurious CO₂ readings while the incubator is below its temperature setpoint)
7. Leave the incubator running for at least two hours (preferably overnight) to allow conditions to stabilize.

6.2 Using the humidity tray



NOTICE! Risk of material damage

- ▶ To avoid possible damage to the CO₂ 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 will cause corrosion inside the incubator.

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 possibility of contamination, every 10 to 14 days, empty the tray, clean it with a solution of 70 % isopropyl alcohol and 30 % distilled water, and then refill it with 1.5 liters of warm distilled water.



The internal chamber will reach approximately 95 % relative humidity at 37 °C using the 1.5 L humidity tray.

6.3 Setting temperature and CO₂

Perform the following steps to program the temperature and CO₂ setpoints. Temperature and CO₂ may be set within the ranges shown in the following table:

Tab. 6-1: Setting temperature and CO₂

Parameter	Available Setpoint Range
Temperature	4 °C to 50 °C
CO ₂	0.2 % to 20 %

To set the Temperature:

1. Press the **Programming** (●) key.
The temperature display will flash.
2. Press the Up (▲) or Down (▼) key until the desired value appears in the left-hand display.
3. Press the **Enter** key to save the setpoint.
The temperature display will stop flashing, and the CO₂ display will flash.
Set the CO₂ level.

To set the CO₂ level:

1. Press the up (▲) or down (▼) key until the desired value appears in the right-hand display.
2. Press the **Enter** key to save the setpoint.



CO₂ gas will NOT be injected until the incubator reaches its temperature setpoint. Allow the incubator to stabilize at the setpoints selected before continuing.

6.4 Autozero system

The purpose of the autozero system is to reference the CO₂ sensor to an atmospheric CO₂ level of 0.05 %. Over a period of time, the sensor baseline may drift, causing an inaccuracy in the CO₂ level at the programmed value.

We recommend that you autozero the CO₂ system:

- Prior to using the incubator for the first time
- Once a month when your incubator is operating, to ensure that the CO₂ level is as accurate as possible
- After the incubator has been in storage (or transit) for a while

To perform the autozero:

1. If you have not already done so, set the CO₂ level (see *Setting temperature and CO₂ on p. 56*). There should be an audible click when the programmed level is entered: this is the CO₂ valve opening.



Autozero can be performed with the incubator programmed at a particular set point and the chamber is immersed in CO₂, or whether the incubator is programmed at 0.0 % and the chamber is immersed in ambient air.

2. Press the  and *Enter* keys simultaneously.



There is a magnetic switch above the door, and a magnet mounted in the door, to switch off the CO₂ valve when the door is opened.

3. The door (and inner doors, if present) must be opened and closed according to the displayed instructions, after which the process is completely automatic.
4. Open the door for 60 seconds to completely degas the chamber. A countdown is shown on the display.
5. When the display instructs you to do so, close the door. An automatic 10-minute countdown will start, to allow the chamber conditions to recover and the CO₂ sensor signal to stabilize.
6. At the end of the countdown, the sensor signal will automatically be re-referenced. If successful the display will flash. Press Programming key to accept.

The incubator will reopen the CO₂ valve to allow the CO₂ level to recover to the setpoint value.




Pressing any key, or opening the door during the autozero will automatically terminate the process and control of CO₂ will restart.

The incubator is now ready for use.

6.5 Programming the alarm system

6.5.1 Setting the high and low temperature alarms

1. Press the **Enter** and  keys simultaneously to enter the alarm menu.
The display will show: °C.AL.
2. Press the **Enter** key to display the High Temperature Alarm, *HI 37.5*. The factory setting is the setpoint value (37.0 °C) + 0.5 °C.

3. Use the Up (▲) or Down (▼) key to adjust the High Temperature Alarm. The minimum setting is 0.5 °C from setpoint.
4. Press the **Enter** key to save the setting.
The Low Temperature Alarm is displayed, *LO 36.5*. The factory setting is the setpoint value (37.0 °C) - 0.5 °C.
5. Use the Up (▲) or Down (▼) key to adjust the value.
6. Press the **Enter** key to accept the setting.
7. Press the **Programming** (●) key twice to exit the menu.

6.5.2 Setting the CO₂ high and low alarms

1. Press the **Enter** and ▼ keys simultaneously to enter the alarm menu.
The display will show: °C.AL.
2. Press the ▲ key until the display shows: *CO2AL*.
3. Press the **Enter** key to display *HI.5.5*. The factory setting is the setpoint value (5.0 %) + 0.5 %.
4. If you wish to adjust the High CO₂ Alarm, use the ▲ or ▼ key. The minimum setting is 0.5 % from setpoint.
5. Press the **Enter** key to save the setting.
The low CO₂ Alarm is displayed, *LO 4.5*. The factory setting is the setpoint value (5.0 %) - 0.5 %.
6. Use the the ▲ or ▼ key to adjust the value.
7. Press the **Enter** key to accept the setting.
8. Press the **Programming** (●) key twice to exit the menu.



If the CO₂ setpoint is programmed at 0.0 % and high and low alarms are accessed, the high will display "0.5" and the low will display "Off".

6.5.3 Door open alarm

When the door is opened, an alarm will sound after a preset time delay. To adjust the time delay:

1. From the alarm menu, press the ▲ key.
The display shows *Doo r.AL* (reading across both displays).
2. Press the **Enter** key and the ▲ and ▼ keys to adjust the time (as you scroll through the available choices, you will see *15, 30, 45, 60, 75, 90* seconds, then *OFF*).
3. Press the **Enter** key to save the desired value.

6.5.4 Alarm duration

Perform the following steps to adjust the alarm duration:

1. From the alarm menu, press the ▲ key until the display shows *PEr .lod* (reading across both displays).
2. Press the **Enter** key and the ▲ and ▼ keys to adjust the Alarm duration.

As you scroll through the available choices, you will see *OFF, 10 SEc, 30 SEc, 60 SEc, 600 SEc, 1 HR*, then *On*).

3. Press the **Enter** key to select the desired value.

6.5.5 Alarm arming delay

The alarm arming delay is the length of time that is allowed for the Temperature and CO₂ to recover after opening the incubator before the Alarm System is armed again. This helps to prevent unnecessary alarms from occurring.

To change the delay:

1. From the alarm menu, press the ▲ key until the display shows *dr.dEL* (across both windows).
2. Press the **Enter** key and the ▲ and ▼ keys to adjust the Alarm Arming time.

As you scroll through the available choices, you will see *0.15 Hr, 0.20, 0.30, 1.00*, then *OFF*.

3. Press **Enter** to select the desired value.
4. Press ● to return to the main alarm programming menu, and press ● again to return to the main display.



When alarm delay is set to OFF, the Alarms will arm only when the programmed setpoint is reached.

6.6 Chamber alarm system

When the incubator is switched **ON**, or after any values have been reprogrammed, the Alarm System is inactive until the setpoint values (± 0.1) are achieved, after which the Alarm System is armed.

If temperature and/or CO₂ levels deviate more than the programmed amount, the display flashes, the audible alarm sounds and a message appears on the screen. You can acknowledge (and cancel) the alarm by pressing any key.

When the outer door is opened, the Alarm System is disabled. When you close the door, the preset Alarm Arming Delay starts. When the delay time expires, the Alarm System is re-armed; if the temperature and/or CO₂ fall below or above the alarm setpoints, the alarm will be activated. If chamber conditions recover within the Alarm Arming Delay time, the Alarm System will be re-armed but no alarm will be activated.

If an alarm is not acknowledged but the chamber conditions subsequently recover, the audible alarm will be cancelled but the alarm message will remain on the screen to alert the user to the fact that an alarm has occurred. You can cancel this alarm message by pressing any key. The duration of the audible alarm can be adjusted from inactive to continuous (see *Programming the alarm system on p. 57*).

6.6.1 Temperature sensor system alarms

There are four temperature sensors: two in the chamber, and two in the door. If any of these sensors should fail, the following message will appear: °C FAIL.

Because the incubator can no longer control temperature properly without the failed sensor, the heating will switch off and the incubator will cool down to room temperature.

If, however, a sensor fails but subsequently corrects itself, the temperature control will restart and an alarm message will remain on the temperature side of the display: *SAL ...* (meaning Sensor Alarm).

This message can be cancelled by pressing any key.

6.6.2 Over-temperature cut-out and alarm

This alarm only occurs if the chamber temperature exceeds the temperature setpoint by 1 °C or if one of the heating elements exceeds a specific activation threshold. The activation threshold is set at the factory and cannot be adjusted.

Following activation, the over-temperature cut-out and alarm system operates in two sequential modes:

Mode 1: The over-temperature cut-out and alarm activates and cuts power to the heating elements and the CO₂ control valve. The condition is shown on the display by the message *°Ctrip*. When the chamber temperature has fallen to the programmed setpoint, the system changes to Mode 2.

Mode 2: The control system then tries to maintain the chamber temperature at the programmed level by switching the heating elements on and off, using an emergency control method that is, however, less precise. The message *TAL* will flash on-screen to signal that an over-temperature fault occurred and the incubator is being controlled by the emergency control system. This message cannot be cancelled via the keypad.

Normal temperature control can be regained and the over-temperature cutout and alarm can be cancelled by reprogramming the temperature, opening and closing the glass door, or switching the incubator off and back on.

If the problem persists, the alarm will recur; if this happens, please contact your service representative or your distributor immediately.

6.6.3 CO₂ control system alarm

This alarm only occurs if the CO₂ AutoZero cannot reference the sensor signal to atmosphere. If this is the case, at the end of the autozero procedure, the following message will appear: *CO2 AUTO ZERO FAI LED*. This means that the CO₂ sensor is defective and requires replacement.

If this alarm occurs, contact your service representative immediately.

6.6.4 Review of alarm messages

For easy reference, the following table provides an overview of all alarm messages that you may encounter across both displays.

Tab. 6-2: Alarm messages

Message	Meaning	Reference
<i>door.AL</i>	Door open	
<i>°CF AIL</i>	Temperature sensor failure	(see <i>Temperature sensor system alarms on p. 59</i>)
<i>SAL</i>	Sensor alarm after sensor recovers	(see <i>Temperature sensor system alarms on p. 59</i>)
<i>°Ct rip</i>	Over-temperature cut-out has cut power to heating elements and CO ₂ valve	(see <i>Over-temperature cut-out and alarm on p. 60</i>)
<i>TAL</i>	Over-temperature defect has occurred and system is under emergency control	(see <i>Over-temperature cut-out and alarm on p. 60</i>)
<i>CO₂ AUTO 2Er0 FAILED</i>	CO ₂ sensor is defective and needs to be replaced	(see <i>CO₂ control system alarm on p. 60</i>)

6.7 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 (see *Main illustration on p. 9*).
- 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 (see *Main illustration on p. 9*).
- Suitable communications software, such as New Brunswick BioCommand SFI or HyperTerminal (included with Windows NT, 95, 98, ME, 2000 and XP).

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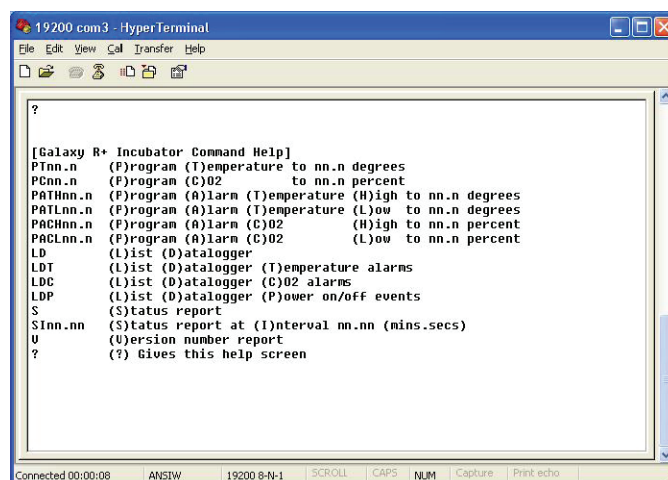
The incubator requires the following settings in the communications software:

Tab. 6-3: 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 5 and then skip to Step 7. If not, continue to Steps 5 and 6.
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, CO₂ and alarm setpoints to be programmed remotely. A running status report can be generated at user-defined intervals, and all reports can be sent to a printer. For details on these features, consult the documentation supplied with your communications software.

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

Tab. 6-4: Remote programming

PTnn.n	(P)rogram new (T)emperature setpoint. Type <i>PT37.5</i> , then press <i>ENTER</i> to reprogram the incubator's temperature setpoint to 37.5 °C.
PCnn.n	(P)rogram new (C)O ₂ level. Type <i>PC04.0</i> , then press <i>ENTER</i> to reprogram the incubator's CO ₂ level to 4 %.
PATHnn.n	(P)rogram new (A)larm (T)emperature (H)igh setpoint. Type <i>PATH38.0</i> , then press <i>ENTER</i> 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 <i>PATL36.0</i> , then press <i>ENTER</i> 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 <i>PACH05.5</i> , then press <i>ENTER</i> 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 <i>PACL04.5</i> , then press <i>ENTER</i> 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. 6-5: Status commands

S	(S)tatus report. Type <i>S</i> , then press the <i>ENTER</i> key to display a current status report, which may look like this: <i>Temperature: Actual 37.0 °C Setpoint 37.0 °C</i> <i>CO₂: Actual 05.0 % Setpoint 05.0 %</i>
SInn.nn	(S)tatus report at (I)nterval of n minutes, n seconds. Type <i>SI60.0</i> , then press the <i>ENTER</i> key to display a current status report (as shown above) every hour. A confirmation message will appear: <i>Status report at interval 60.0 will be given</i> <i>Press "Enter" or "ESC" to stop reports</i>

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:

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Tab. 6-6: Other commands

V	Type <i>V</i> , then press the <i>ENTER</i> key to generate a report on the current firmware version.
?	Type <i>?</i> , then press the <i>ENTER</i> 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. 6-7: Messages

Type of Message	Message
Alarm	<i>TEMPERATURE LOW</i>
Alarm	<i>TEMPERATURE HIGH</i>
Alarm	<i>CO₂ LOW</i>
Alarm	<i>CO₂ HIGH</i>
Alarm	<i>TEMPERATURE SENSOR FAILURE</i>
Alarm (AutoZero)	<i>PROG CO₂ A/Z SYSTEM INOPERATIVE</i>
AutoZero Event	<i>PROG CO₂ A/Z COMPLETED OK</i>
Door Event	<i>DOOR OPENED</i>
Door Event	<i>DOOR CLOSED</i>

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

[DOOR EVENT] DOOR OPENED

Temperature: Actual 37.0 °C Setpoint 37.0 °C

CO₂: Actual 00.1 % Setpoint 05.0 %

7 Troubleshooting

7.1 O₂ 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 hydrophobic filter holder assembly (see *Replacing the filter disc on p. 48*) by unscrewing it (counter-clockwise).
2. Program the incubator for a temperature of at least 37 °C (or higher if you normally operate the incubator at a higher temperature).
3. Close the door and allow the temperature to recover.
4. Reopen the door for 15 seconds to release any build-up of humidity.
5. Repeat steps 3 and 4 every 30 minutes while monitoring the *DATALOGGER O₂* Graph. The oxygen level should recover after a few hours.
6. Leave the incubator for a few more hours to be ensure that the sensor membrane has thoroughly dried out.
7. Replace the hydrophobic filter disc (see *Replacing the filter disc on p. 48*).
8. Re-humidify the incubator.
9. After 2 to 3 hours, carry out an *OXYGEN SENSOR-REF TO ATMOSPHERE* (see *Referencing to atmosphere on p. 45*). When the referencing has been successfully completed, the incubator is ready for use.

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8 Maintenance

8.1 Routine maintenance

8.1.1 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. 23*).

8.1.2 Daily Checks

1. Check that the temperature and CO₂ levels are reading within specification.
2. Check the reserve pressure in the CO₂ cylinder (normally 725 PSI (50 bar) when full). The design of the incubator ensures very low consumption of CO₂. 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 CO₂ supply and will help avoid accidentally running out of CO₂.
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 (48R only).

8.1.3 Weekly checks



Use distilled water only in the humidity tray. Use of any other types of water including deionized water 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.

8.1.4 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 CO₂ sample port, and check it using a CO₂ gas analyzer (see *CO₂ Sampling with analyzer on p. 68*).



Displayed chamber CO₂ level will drop during sampling, but it will recover once the sampling is complete. This is merely a sensor characteristic; the CO₂ level in the chamber is actually not affected.

We recommend that you perform a CO₂ autozero prior to sampling. We also recommend that you autozero the CO₂ system at least once every 28 days to ensure that CO₂ level is correct.

8.1.5 CO₂ Sampling with analyzer

The CO₂ sample port is located on the rear of the incubator, near the top (see *Main illustration on p. 9*).

If you conduct a sampling, please ensure the following:

- Turn off the CO₂ gas by re-programming the setpoint for CO₂ to 0.0 % to prevent CO₂ 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 CO₂ setpoint to the desired level after sampling.



We recommend that you perform a CO₂ autozero prior to sampling. We also recommend that you autozero the CO₂ system at least once every 28 days to ensure that CO₂ level is correct.

8.2 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.

8.3 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 CO₂ sensor cover at the rear of the chamber. Failure to use the protective cover(s) could result in damage to the sensor(s) and may affect your warranty.



Use distilled water only in the humidity tray. Use of any other types of water including deionized water 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 % CO₂ 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 CO₂ 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 CO₂ 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. 23*). 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 CO₂ level. It may be necessary to open the glass door briefly if, after performing an autozero, the CO₂ level is too high.

8.4 High temperature disinfection

If your incubator is supplied with the high temperature disinfection option, follow the guidelines outlined (see *Using the high temperature disinfection on p. 36*) for information on how to correctly and safely operate this option.

9 Transport, storage and disposal

9.1 Transport



NOTICE! Risk of material damage

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

9.2 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.

9.3 Storage

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

10 Technical data

10.1 Weight/dimensions

10.1.1 Equipment dimensions

Width	48.3 cm (19.0 in)
Height	64.5 cm (25.4 in)
Depth	47.5 cm (18.7 in)
Net weight	31.8 kg (70.1 lb)

10.1.2 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)

10.1.3 Transporting dimensions

Width	63 cm (24.8 in), pallet included
Height	87.0 cm (34.4 in), pallet included
Depth	58.5 cm (23.0 in), pallet included
Weight	50 kg (110.2 lb)

10.1.4 Shelves

Polished stainless steel, perforated (standard).

Usable area:	875 cm ² (344.5 in ²)
Number of shelves:	<ul style="list-style-type: none"> • 3 standard • Multiple position option • Up to 6 shelves

10.2 Power supply

10.2.1 Mains/electrical supply

Mains/power connection	120 V, 50 Hz 120 V, 60 Hz 230 V, 50 Hz 230 V, 60 Hz
Power consumption for standard models	500 W
Energy to maintain 37 °C	< 0.1 kWh

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10.3 Fuses

Fuse for Galaxy 48 R (120 V or 230 V)	5 A
Fuse for Galaxy 48 S (120 V or 230 V)	4 A

10.4 Ambient conditions**10.4.1 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
Recovery rate	(see <i>CO₂ recovery on p. 75</i>)



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

10.4.2 CO₂ control

Solid-state infrared CO₂ sensor operating independent of humidity. Programmable, fully automatic zeroing function.

Range	0.2 - 20 %
Control	± 0.1 %
Stability	± 0.2 %
Uniformity	± 0.1 %
Recovery rate	(see <i>CO₂ recovery on p. 75</i>)
Gas connections	6 mm tubing
Required gas pressure	5 PSI (0.35 bar)

10.4.3 Relative humidity

Removable stainless steel humidity tray.

Reservoir capacity	0.5 liters
Humidity control: manual	Normal: 95 % at 37 °C High: 97 % at 37 °C

10.4.4 Altitude limit

Altitude limit	2000 m (2187.23 yd)
----------------	---------------------

10.4.5 Storage temperature

Air temperature	10 - 50 °C
-----------------	------------

10.5 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 7 PSI (0.5 bar)
Typical oxygen reduction rates	3 minutes to 16 % 4 minutes to 11 % 8 minutes to 6 %

10.6 CO₂ recovery

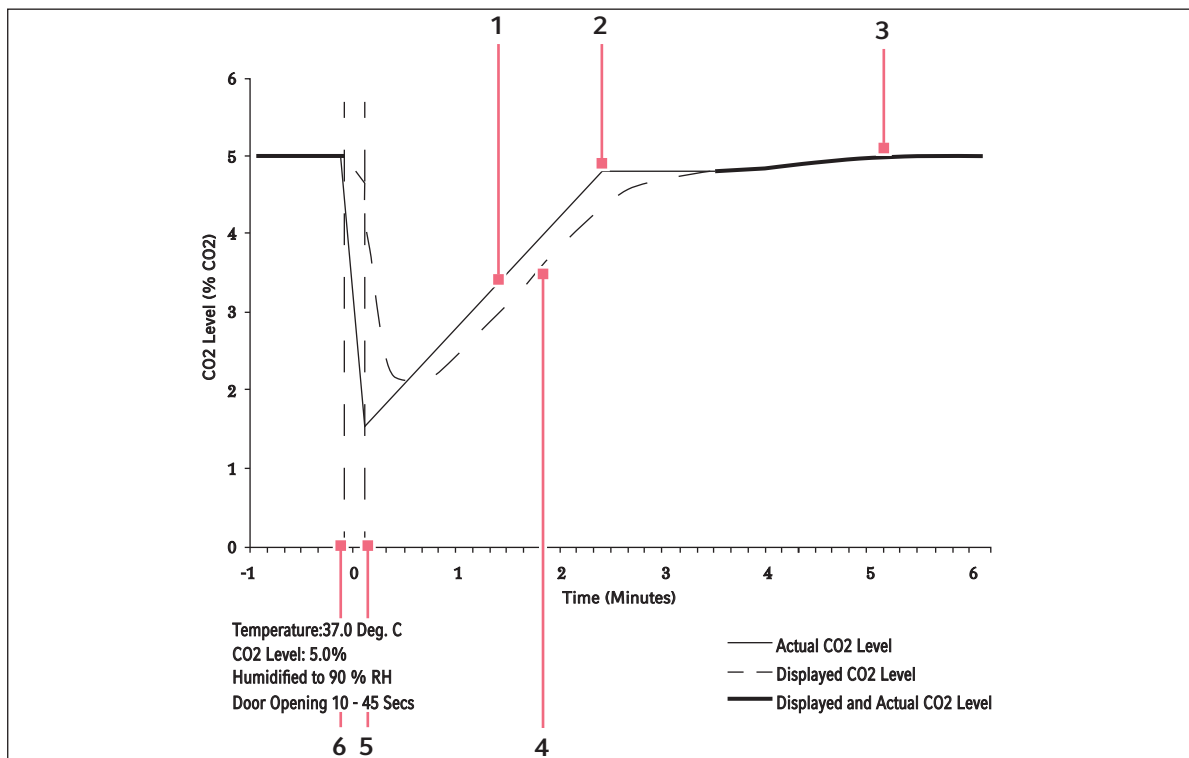
After a door opening, it should be possible for the actual CO₂ level to recover to around 4.8% in 2 to 2.5 minutes.

The displayed CO₂ level takes 30 to 45 seconds more to catch up with the actual level. This is because it takes approximately 45 seconds from the time the gas enters the chamber to fully mix and become uniform inside the sensor.

This graph shows typical results for door openings between 10 and 45 seconds. The control system does this by speeding the sensor reaction time when the door is opened and then slowing it down to produce a more accurate reading after the setpoint level is achieved.

Technical dataGalaxy® 48 R/48 S CO₂ Incubators

English (EN)

Fig. 10-1: Actual vs. displayed CO₂ levels

- | | |
|--|-----------------------------------|
| 1 Actual CO ₂ level | 4 Displayed CO ₂ level |
| 2 CO ₂ valve close point | 5 Door closed |
| 3 Displayed and actual CO ₂ level | 6 Door opened |

11 Ordering information

11.1 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 (48R only)	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.

11.2 Available options

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

- O₂ Control, 1 – 19 %
- O₂ Control, 0.1 – 19 %
- O₂ Control, 1 – 95 %
- High temperature disinfection
- Humidity alert and monitoring package
- Split inner door
- Building management system relay
- Internal power receptacle
- Upper stacking frame
- Lower and upper stacking frame
- Under-bench stand, 200 mm high with feet

Ordering information

Galaxy® 48 R/48 S CO₂ Incubators
English (EN)

12 Installation instructions for stacking stand kit

12.1 Lower and upper stacking frame, with castors

This kit is designed to stack 2 Galaxy 48 R/48 S units.

12.1.1 Base stand assembly instructions

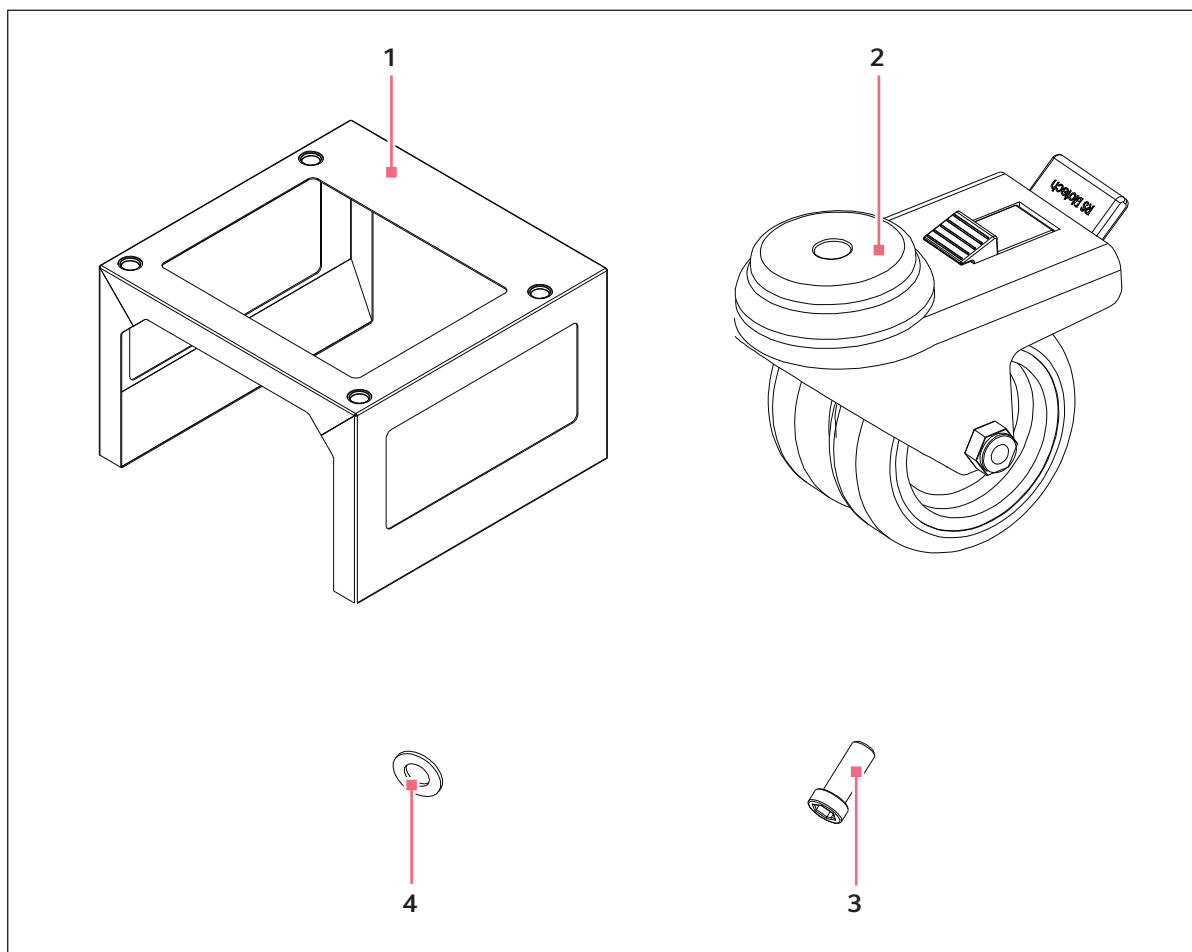


Fig. 12-1: Base stand components

1 Base stand
x 1

2 Locking castor
x 4

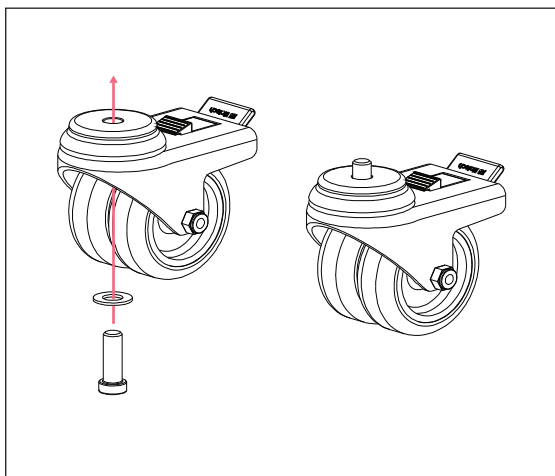
3 M10 bolt
x 4

4 M10 washer
x 4

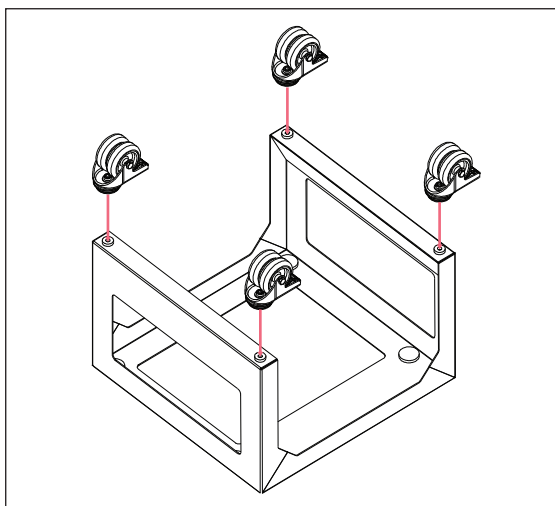
To assemble the base stand:

Installation instructions for stacking stand kitGalaxy® 48 R/48 S CO₂ Incubators

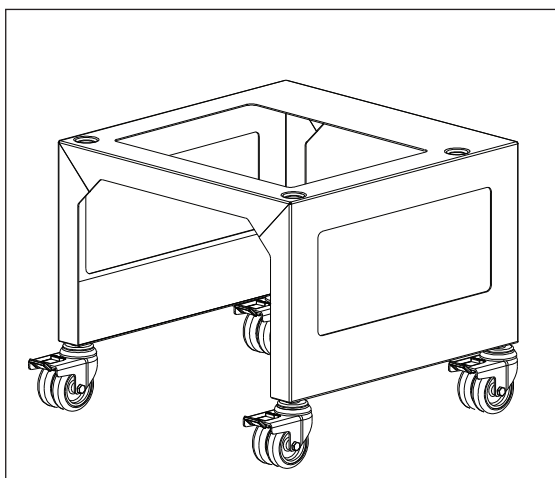
English (EN)



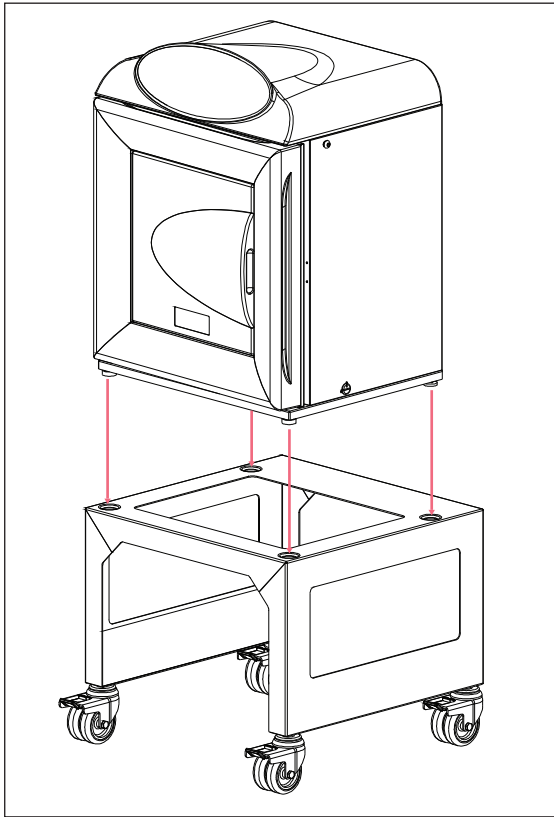
1. Remove components from packaging.
2. Identify Base Stand, Castors, M10 Lock - Nuts and Washers (see Fig. 12-1 on p. 79).
3. Assemble bolts and washers to castors, making sure that the washer is placed inside the castor.



4. Turn base face down and assemble castors using hex key provided.



5. Turn base right way up and place on castors.



6. With the help of a second person place the Galaxy 48 R/48 S onto the base-stand making sure that the feet are located in the embossed areas.
7. Adjust the height of the feet on the bottom incubator to ensure equipment is level. Use a spirit level on the bottom shelf of the incubator if necessary.
8. Install the top stand bracket.



From this point on, this incubator will be referred to as the *bottom incubator*.

Installation instructions for stacking stand kitGalaxy® 48 R/48 S CO₂ Incubators

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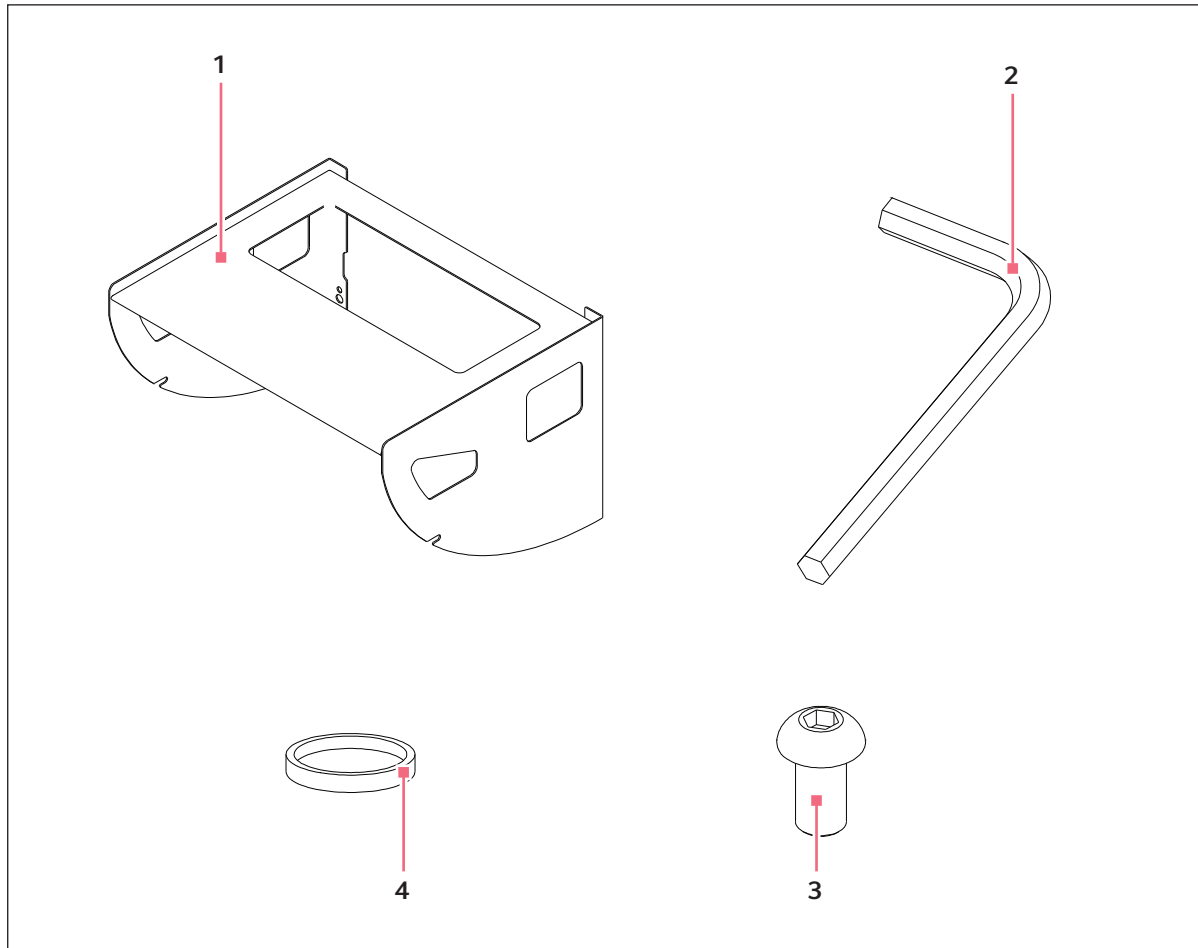
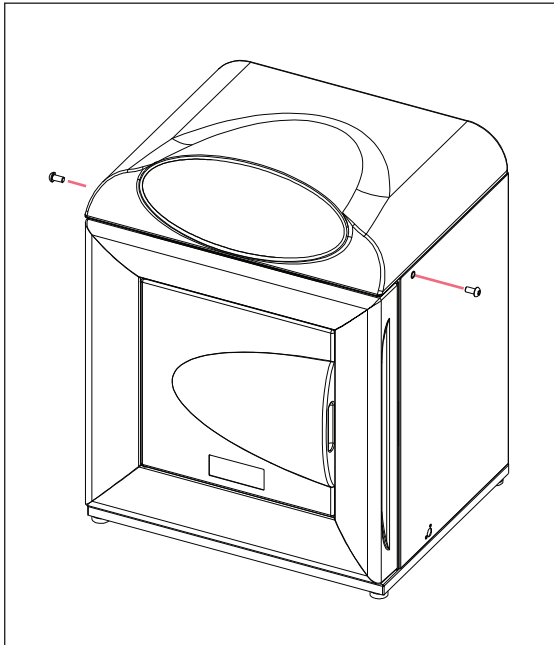
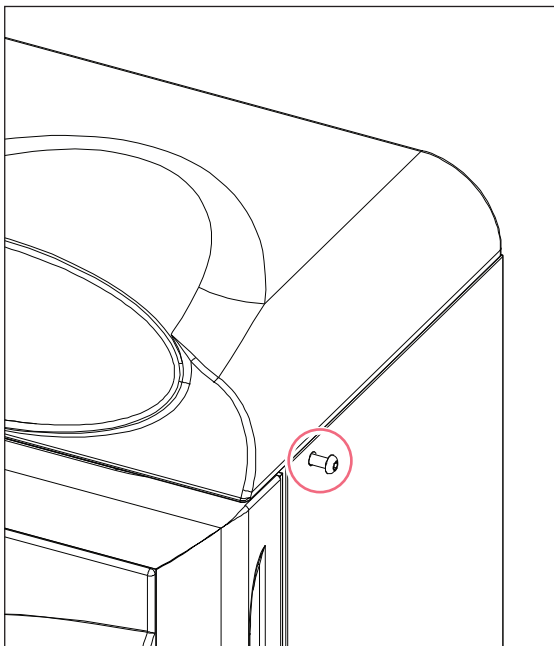
12.1.2 Top stand bracket assembly instructions

Fig. 12-2: Top stand components

1 Top stand
x 1**2 Hex key**
5 mm AF**3 M8x16 button head screw**
x 4**4 Anti-slip pads**
x 4



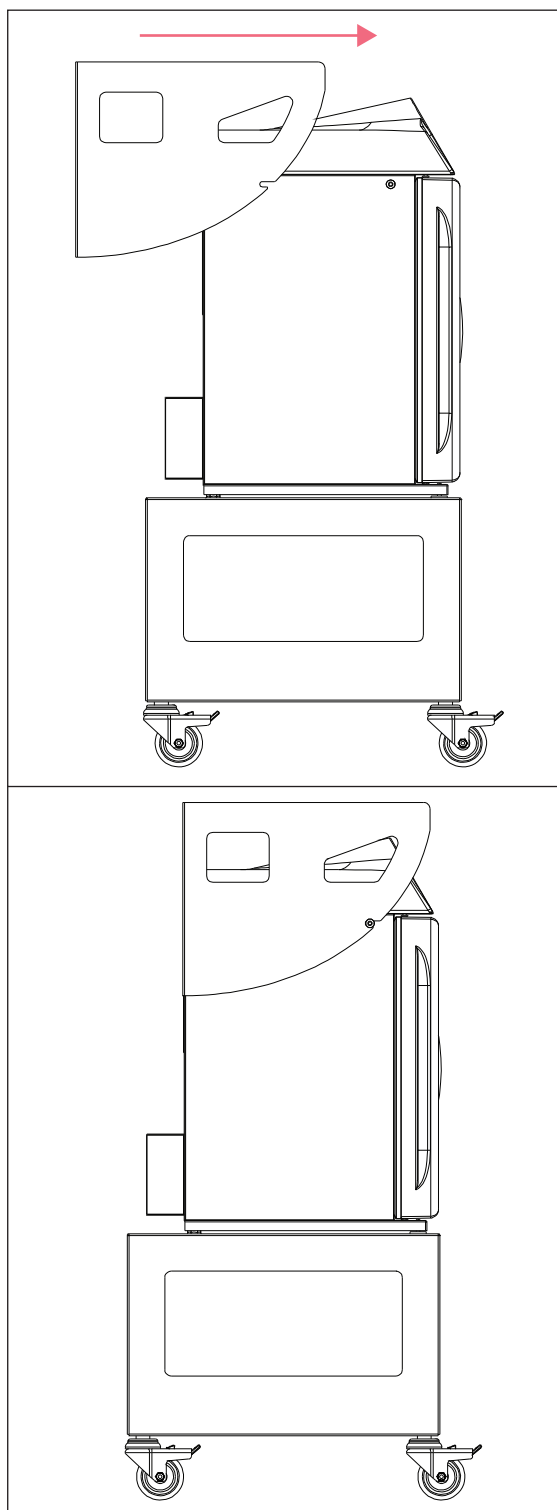
1. Identify Top Stand Bracket, M8x16 Button Head Screws, Anti-Slip rubber pads (supplied with Incubator) and Hex Key (see Fig. 12-2 on p. 82).
2. Remove the black blanking plug from either side of the **bottom** incubator.
3. Using 2 of the M8x16 Button Head Screws, partially screw one into the threaded hole on either side of the bottom incubator.



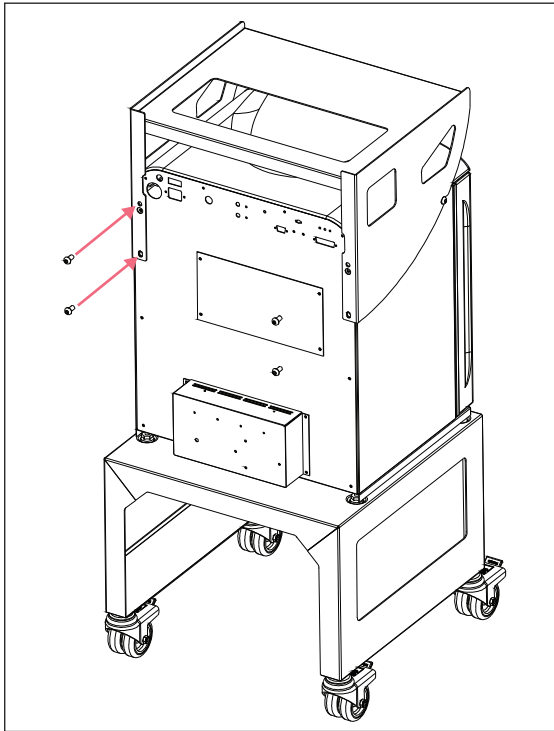
4. Leave a 5 mm gap between the wall of the incubator and the head of the screw.

Installation instructions for stacking stand kitGalaxy® 48 R/48 S CO₂ Incubators

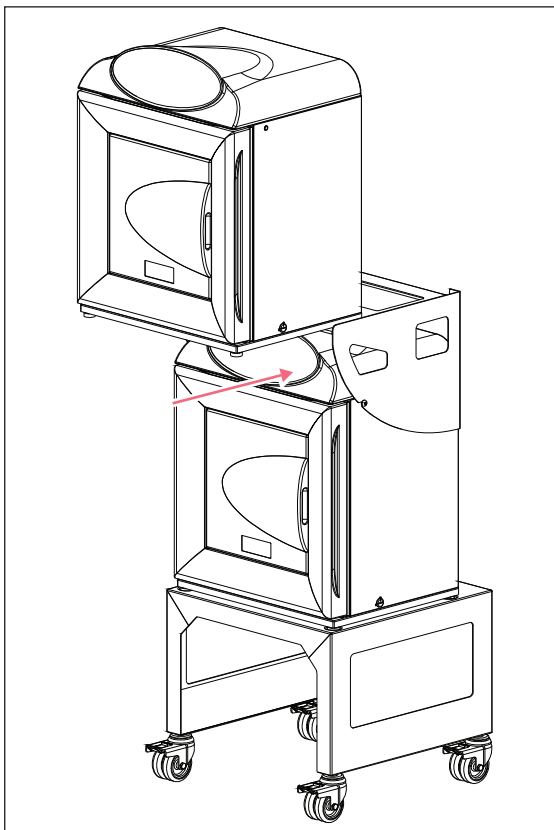
English (EN)



5. Slide the Top Stand Bracket forward until the slots locate on the screws.



6. Partially screw the remaining M8x16 Button Head Screws into the threaded holes in the rear of the bottom incubator.
7. **Fully tighten** the four screws on the rear of the incubator followed by the sides.
8. Attach the 4-off Anti Slip pads to the feet of the top incubator.



9. With the help of a second person, place the remaining incubator on the Top Stand Bracket by sliding it in from the front.
10. Adjust the height of the feet on the top incubator to prevent any rock on the unit. Use a spirit level on the bottom shelf of the incubator if necessary.
11. Place the entire assembly on a flat piece of floor to prevent rock on the whole unit. Lock each castor once the unit is in position.

Installation instructions for stacking stand kit

Galaxy® 48 R/48 S CO₂ Incubators

English (EN)

12.1.3 Specifications

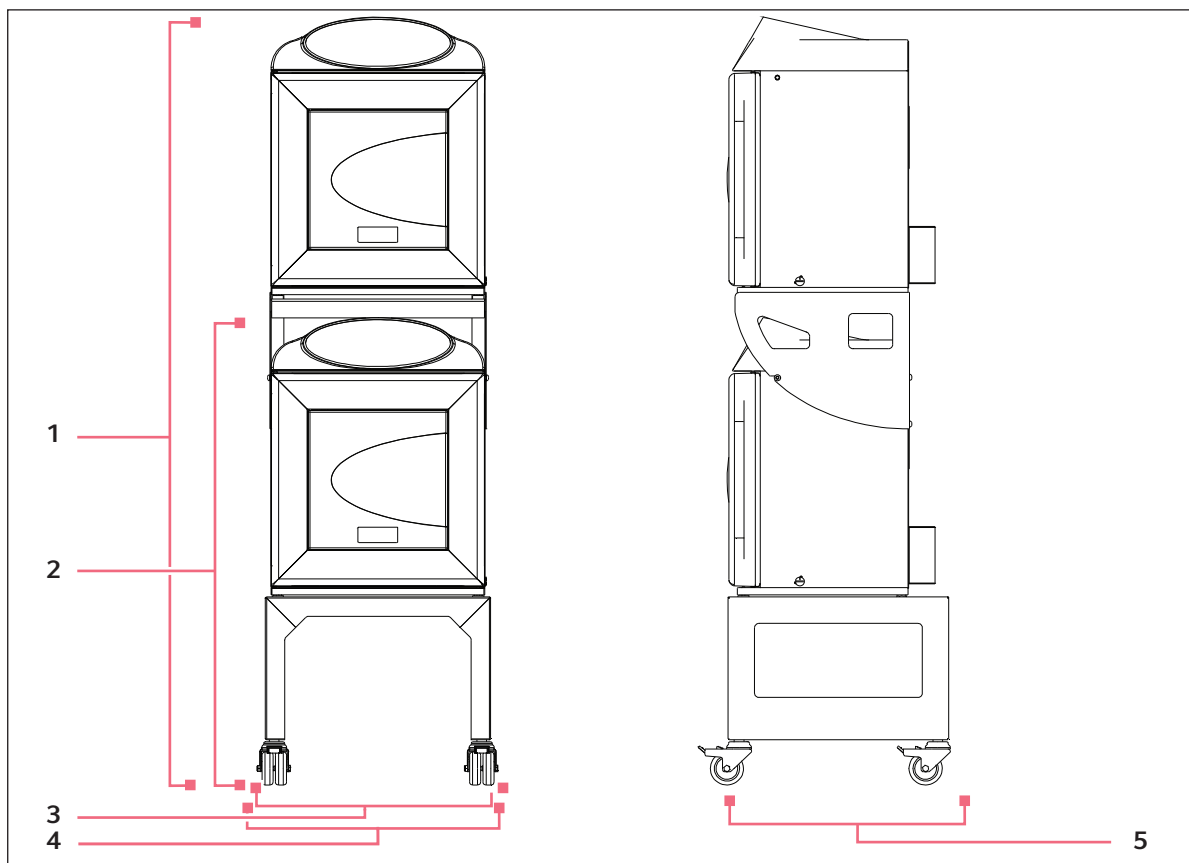


Fig. 12-3: 2 Galaxy 48 R/48 S units stacked

Tab. 12-1: Stacked dimensions

	Measurement	Item number
1 unit with base	1062 mm (41.8 in)	2
2 units stacked with base	1743 mm (68.6 in)	1
Width to outside of castor (if castor is facing forward)	545 mm (21.5 in)	4
Width to side of unit	510 mm (20.1 in)	3
Depth of base	500 mm (19.7 in)	5

Packaged width	530 mm (20.9 in)
Packaged depth	540 mm (21.3 in)
Packaged height	350 mm (13.8 in)
Packaged weight	17 kg (37.5 lb)
Volumetric weight	17 kg (37.5 lb)

13 Declaration of conformity

eppendorf


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:
CO₂ 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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Fig. 13-1: 48 R declaration

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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 S

including accessories

Product type:

CO₂ Incubator

Relevant directives / standards:

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

2004/108/EC: EN 61326-1

2011/65/EU

H.-G. Köhl

Management Board

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Fig. 13-2: 48 S declaration

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