eppendorf

Galaxy® 14 S CO$_2$ Incubators

Operating manual

6700 900.019-00/012014

Table of contents

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

1.3   Symbols used

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

2 Safety

2.1 User profile

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

2.2 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 Product description

3.1 Main illustration
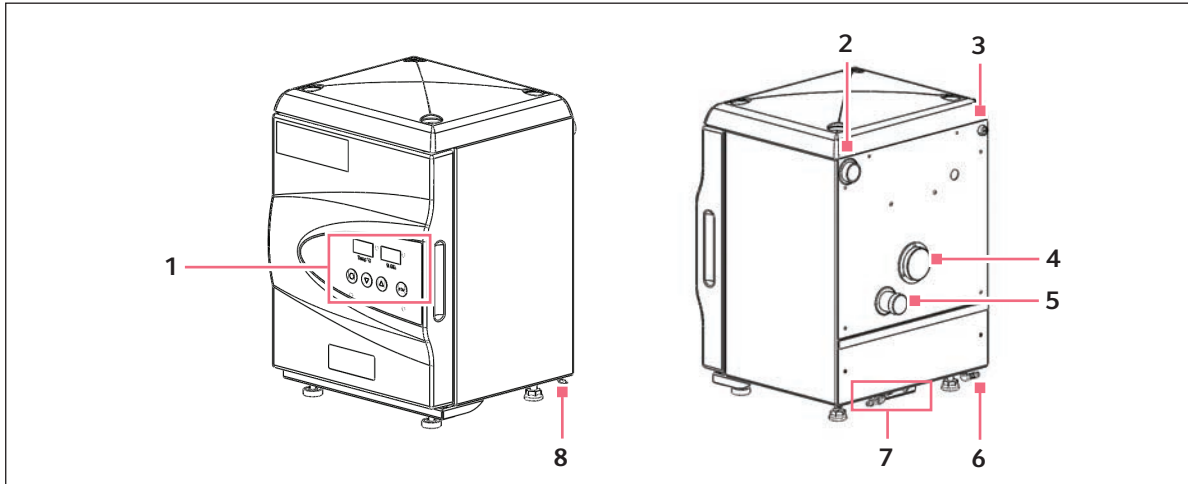
Fig. 3-1: Front and back view of the Galaxy 14 S CO$_2$ Incubator

1 Control panel
Controls operation of the incubator (see *14 S control panel on p. 19)*.

2 CO$_2$ sensor cover holder

3 4 A fuse

4 Access port

5 O$_2$ sensor

6 CO$_2$ gas inlet

7 Mains/power socket, RS232 port, and N$_2$ inlet

8 CO$_2$ gas sample port

3.2 Features

The Galaxy 14 S CO$_2$ Incubator is microprocessor-controlled and designed to ensure accurate and reliable operation.

3.2.1 Control system

The incubator incorporates a simple, door-mounted keypad with two three-digit LED displays that allow for easy programming and monitoring of the chamber conditions.

3.2.2 Direct heating system

A direct heat system, utilizing a thermal heating element, completely surrounds the incubator, providing an even temperature within the chamber. The independently heated outer door is designed to ensure an even distribution of heat and eliminate condensation on the door. This system ensures a rapid, controlled return to optimum chamber conditions after a door opening while also preventing any overshoot.

3.2.3   Infrared sensor

A solid-state infrared sensor is used to control the level of CO_2, providing excellent reliability and remaining unaffected by humidity. The CO_2 system has a semi-automatic zero function ("AutoZero") that provides a simple process to maintain an accurate level of CO_2 within the chamber.

3.2.4   Seamless chamber

The 14 L, seamless, deep-drawn chamber and all internal components are manufactured from stainless steel. The non-tip shelves, 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 reducing small sample evaporation within the chamber. The outer shell of the incubator is manufactured from paint-powder-coated steel to give a durable corrosion-resistant finish.

3.2.5   Controlled humidity tray

A water tray at the bottom of the incubator allows a high, uniform relative humidity while preventing condensation in other parts of the chamber.

3.2.6   Two-level alarm system

The incubator incorporates a two-level alarm system. The chamber-monitoring alarms are programmable and will alert you if the door has not been closed. If it is not required, this system can be disarmed. The system alarms occur only if a system component problem has developed that requires user intervention to rectify. The incubator also incorporates an over-temperature safety system that operates independently from the main control system.

3.2.7   Standard features

The Galaxy 14 S model contains many standard features usually seen as options, such as a 25 mm access port to allow for seamless integration of independent probes or other equipment through the chamber. In addition, there is an RS232 port as standard on all new Galaxy 14 S incubators. This port will communicate with any computer through a hyperlink access or can be used to externally datalog the incubator through Eppendorf software.

3.2.8   General

The incubator's direct heat system was designed with optimal use of laboratory space in mind. It allows the most efficient internal volume for the footprint of the instrument. In addition, the incubator's top panel is specifically designed to support the weight of a second identical incubator stacked directly on top of the first. A stacking stand is needed to stack the incubators (see *Available accessories on p. 49)*.

4 Installation

4.1 Inspection of boxes

After you receive your order from Eppendorf, inspect the boxes carefully for any damage that may have occurred during shipping. Report any damage immediately to the carrier and to your local Eppendorf Customer Service Department.

4.2 Unpacking

Disassemble the shipping crate and remove the cardboard, fitted foam and protective packing. Save the packing materials for possible future use, and be sure to save this Operating Manual for instruction and reference.

Locate and remove the parts stored inside the incubator and the bag outside the incubator that contains tubing and the power cord.

Using your packing list, verify that you have received the correct materials, and that nothing is missing. If any part of your order was damaged during shipping, is missing, or fails to operate, fill out the "Customer Feedback" form, available online at http://newbrunswick.eppendorf.com

The following table outlines the accessory items that are supplied with your new incubator:

Quantity	Item	Notes
2	Non-tip Shelves	Installed
2	Wire Shelf Racks (one for each side)	Installed
1	Humidity Tray	Installed
8	Silicone Rubber Extruded Rack Guards	Installed
1	White porous CO_2 Sensor Cover	Installed (additional 1 porous cover shipped in accessories bag)
1	Black Sensor Cover	Installed
6	Silicone Rubber Suction Pads	Packed in accessories bag
1	Mains/Power cord	Packed in accessories bag
3 m (9.8 ft)	PVC Tubing, ~1/4 inch or 6 mm bore, with an inline CO_2 filter connected, ready for use	Packed in accessories bag
2	Hose Clips	Packed in accessories bag
4	Adjustable Feet, with locking nuts	Packed in accessories bag
4	Anti-slip Pads for adjustable feet	Packed in accessories bag
1	Operating manual	Supplied

⚠️ **WARNING!**

▸ Anytime you touch or handle the white CO_2 sensor cover, be sure to wear gloves, and do not later touch those gloves to your face. Discard or wash the gloves.

4.3 Utilities

In order to use the incubator, you will need:

Utility	Requirement
Electricity	110/120 V, 50/60 Hz grounded electrical supply with min. capacity of 6 A
	OR
	220/240 V, 50/60 Hz grounded electrical supply with min. capacity of 3 A
CO_2 Gas	Cylinder with 100 % CO_2 vapor withdrawal, together with an in-line regulator for pressure control to 5 psi/0.35 bar

4.4 Selecting the location

Remove the incubator from the pallet and place the incubator in the working position.

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 ranging from 4.0 °C above ambient to 50 °C and up to 2000 m in altitude.

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;
• Do not position the equipment so that it is difficult to unplug the device.

🛈 If you plan to stack two incubators, be sure to factor the extra weight (second incubator plus options and contents) into your choice of location, and be sure to use the stacking stand (#P0628-6230) for a safe installation.

The incubator is designed so that one incubator can be safely stacked on top of another identical incubator. It is not possible to put any other type of incubator or heavy apparatus on top, as the top cover is designed to support only the feet of another 14 S Incubator.

4.5   Setting up
4.5.1   Install the feet:

To ensure adequate airflow for correct operation, the incubator feet must be installed. The feet come in two thread sizes: there are two small-thread-sized front feet and two large-thread-sized rear feet.

To insert the adjustable feet:

1. Make sure the locking nuts are installed onto each of the four feet provided.
2. Put an anti-slip pad (provided) on each foot.
3. Beginning with the front pair: tilt the incubator toward the back, and screw the feet in, to the required depth.
4. Tilt the incubator forward to install the rear pair of feet, in the same manner as above.

4.5.2   Install the wire shelf racks and shelves:

> ⓘ   Wire shelf racks come preinstalled. Installation is needed only if the racks were removed.

1. Each wire shelf rack has silicone suction cups and split tubing that hold the rack in place. Attach three of the suction feet and four of the split silicone tubing sections to each shelf rack in the positions shown in the following Figure. Leave a gap of approximately 10 mm (½ inch) between the bottom of the silicone tubing and the bottom shelf rung. This will allow the bottom shelf to be inserted with ease.
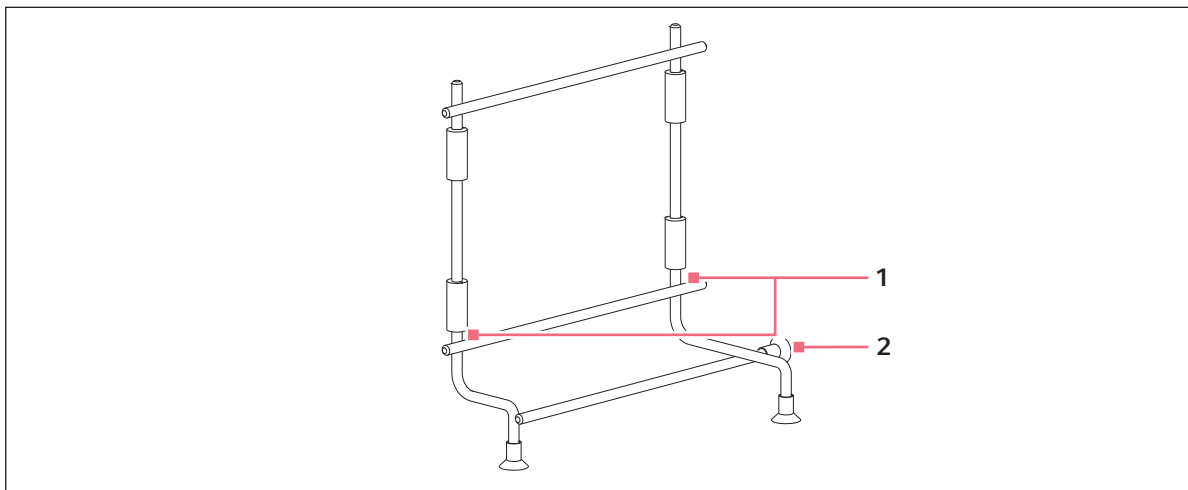
Fig. 4-1:   Shelf rack setup (left side)

1 Leave a 10 mm gap here   **2 Rear suction cup**

2. Place the shelf racks in the incubator chamber, making sure that each rack's rear suction cup is pressed firmly against the rear of the chamber and that each piece of silicone tubing is touching the chamber wall. They will fit correctly only one way:
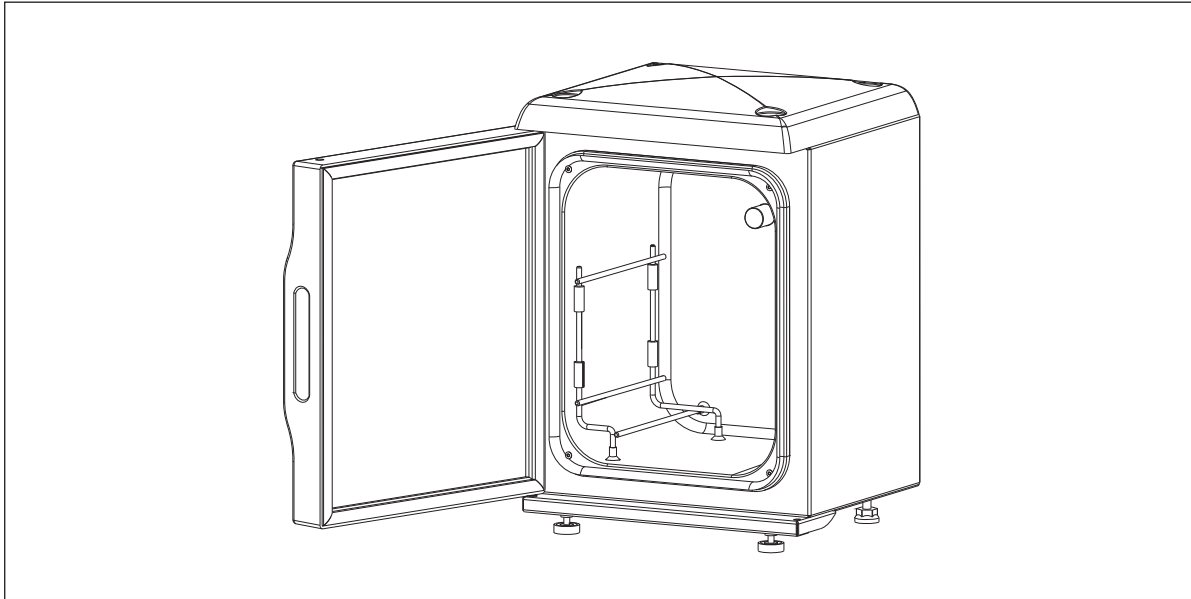
Fig. 4-2:   Shelf rack installed (left side)

3. Beginning with the bottom shelf, install both shelves. Make sure that each shelf's anti-tip groove is properly inserted onto each of the wire shelf rack guides. For orientation, the front edge of the shelf faces downward while the back edge of the shelf faces upward.
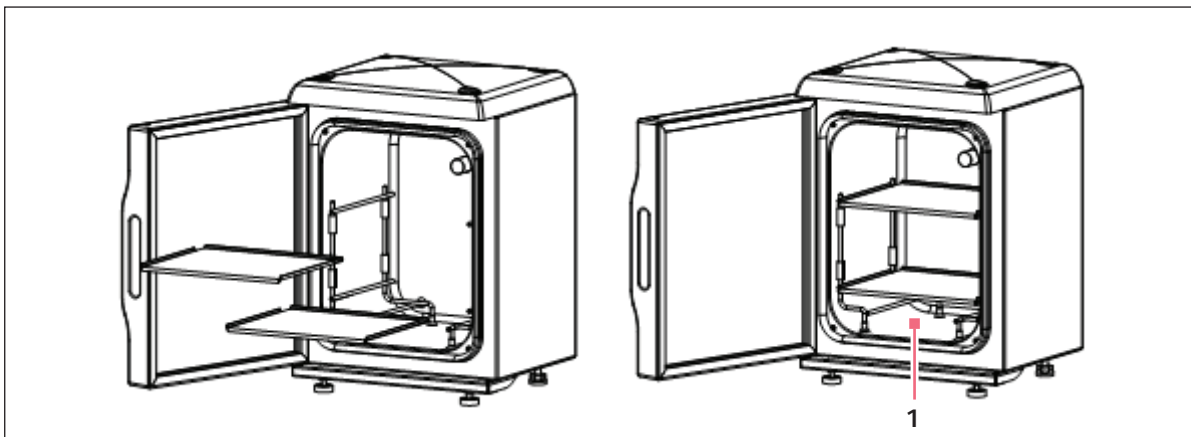
Fig. 4-3:   Installing the shelves

1 Humidity tray slides in here

4.5.3   Level the incubator by adjusting the feet:

1. Place a small level on the top shelf of the incubator.
2. Adjust the leveling feet until the incubator is level and stable.
3. Lock the leveling feet in place by tightening the locking nuts on each foot.

4.5.4   Install the humidity tray:

1. Install the humidity tray between the lowest supports of the wire shelf racks:
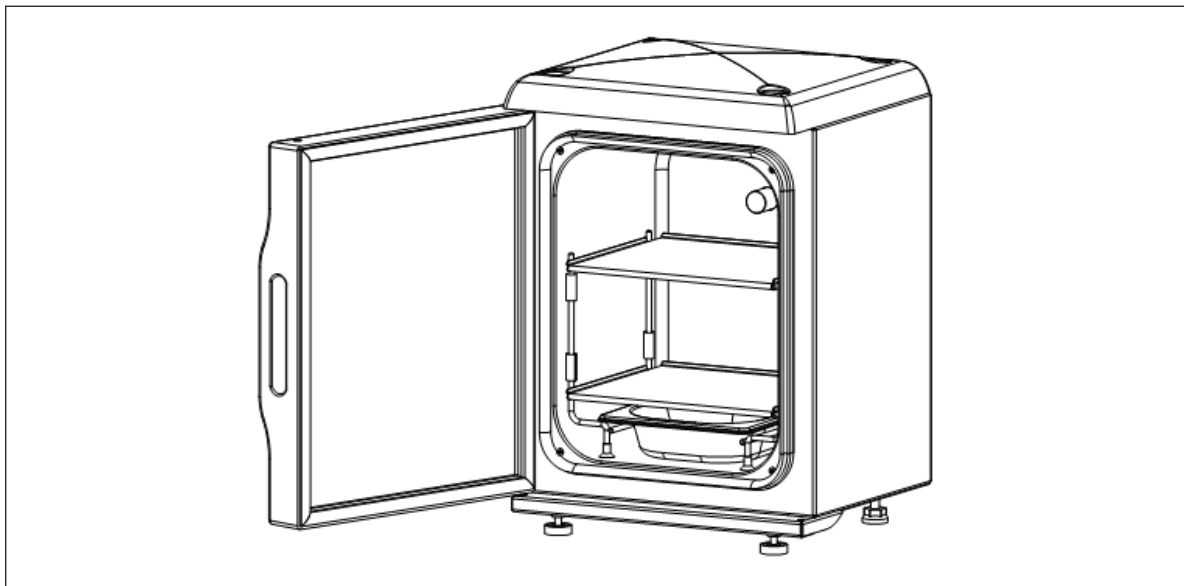
Fig. 4-4:   Shelf racks, shelves, and humidity tray installed

2. Ensure that the humidity tray is centered between the supports.

4.5.5 Connect the CO_2 gas supply:
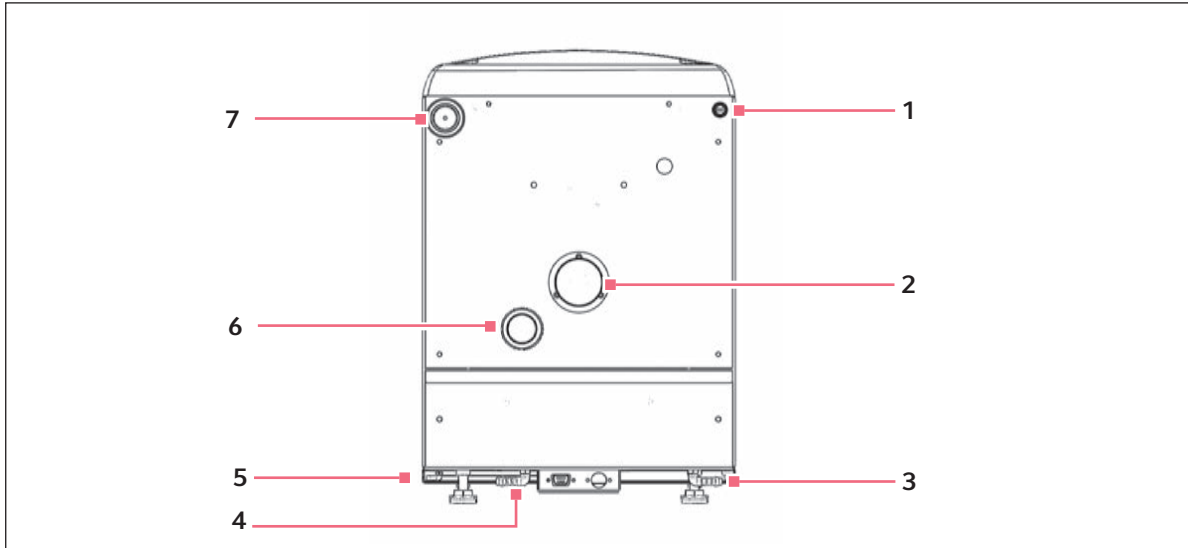
Fig. 4-5: Rear panel

1	**4 A fuse**	**5**	**CO_2 gas sample port**
2	**O_2 sensor** Optional	**6**	**25 mm access port**
		7	**CO_2 sensor cover holder**
3	**CO_2 gas inlet**		
4	**N_2 gas inlet**		

1. Connect the incubator to the CO_2 supply using the 6 mm (~¼ inch) plastic tubing, with the installed filter, by attaching the tubing between the two-stage regulator (or in-line regulator) and the matching CO_2 inlet on the rear of the incubator.

   It is highly recommended that an in-line regulator be used at the incubator's gas inlets.

2. Use the tubing clips provided to eliminate CO_2 leaks.

3. Turn on the gas supply with the pressure set to 0.35 bar (5 psi).

   Be certain to check for leaks in the CO_2 connections to avoid depleting your CO_2 gas supply. This can be accomplished using a solution of soapy water applied to each fitting and checking for bubbles. If any bubbles are noted, readjust the fitting.

WARNING!

▸ Slightly increased levels of CO_2 may be found in and around the operating area of the CO_2 incubator. Over time, this can have adverse effects on those exposed to such an environment. Users working in environments with elevated levels of CO_2 should take all appropriate precautions to protect their breathing.

NOTICE!

‣ Failure to remove the black CO_2 sensor cover will cause the incubator to operate incorrectly.

4. Remove the black protective cover from sensor (store it on the back of the incubator for use when disinfecting). Ensure that the white porous sensor cover remains in place.

4.5.6   Install the power cord:

NOTICE!

‣ Only use power cord provided.
‣ Do not use inadequately rated power cord.

1. Insert the power cord into its receptacle on the bottom left of the incubator's rear panel (see Fig. 4-5 on p. 16).

CAUTION!

‣ Do not position the equipment so that it is difficult to unplug the device.

2. Press the cord firmly into the socket.

5 Operation

5.1 14 S control panel

The control panel consists of two individual three-digit LED displays, and four function keys:
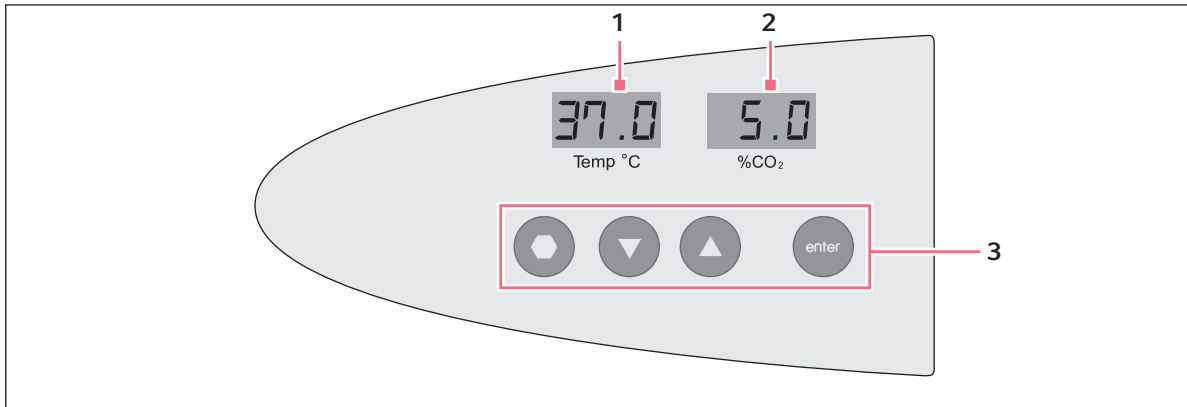
Fig. 5-1:   14 S Incubator control panel

1 Temperature display

2 CO_2 display

3 Function keys

Tab. 5-1: Function keys

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.

5.2   Preparing for operation

1. Remove the black protective cover from the CO_2 sensor (if not already removed), and store it for use later, when you clean the incubator. There is a storage holder on the rear panel of the incubator.

2. Ensure that the white porous sensor cover remains in place.

3. Remove the silica gel dessicant sachet.

4. Using the mains/power cord provided, connect the incubator to a earthed/grounded mains/power supply. The display will illuminate immediately.

   ⓘ The incubator does not contain a main power switch, and will turn on immediately when connected to a power source. If the power receptacle has a switch, make certain the power receptacle is switched on. When the incubator turns on, the decimal points on the display for Temperature and CO_2 flash on and off to signify that the Alarm System is not armed.

5. Turn on the gas supply (if not already on) with the pressure set to 5 psi or 0.35 bar (for incubators without oxygen control).

   ⓘ Be certain to check for leaks in the CO_2 connections to avoid depleting your CO_2 gas supply. This can be accomplished by applying a solution of soapy water to each fitting and checking for bubbles. If any bubbles are noted, readjust the fitting.

6. The chamber setpoints are pre-programmed at 37.0 °C and 5.0 % CO_2.

5.3   Using the humidity tray

If you are not planning to humidify the incubator, leave the humidity tray in place and skip this section.

❄ **NOTICE! Risk of material damage!**

  ‣ Never leave water in the humidity tray if the incubator is switched OFF, as this may cause damage to the CO_2 sensor.
  ‣ NO CHLORINATED SOLVENTS should be used in the humidity tray.

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1. Fill the humidity tray with 0.3 liters of warm (~37.0 °C) distilled water.

2. *For cell culture work*, we recommend the addition of 0.5 g of copper sulphate or another recognized biocide (NO CHLORINATED SOLVENTS) 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.

3. *For IVF and other sensitive work*, we do **not** recommend the use of any biocide in the humidity tray. To reduce the possibility of contamination, every 10 – 14 days the humidity tray water should be changed and the humidity tray (NO CHLORINATED SOLVENTS) should be cleaned with a solution of 70 % isopropyl alcohol and 30 % distilled water.

5.4 Setting temperature and CO_2

Perform the following steps to program the temperature and CO_2 setpoints. Temperature and CO_2 may be set within the ranges shown in the following table:

Tab. 5-2: Setting temperature and CO_2

Parameter	Available Setpoint Range
Temperature	10 °C to 50 °C (must be at least 5 °C above ambient)
CO_2	0.2 % to 20 %

To set the Temperature and CO_2:

1. Press the **Programming** (⬤) key.
   The temperature display will flash.

2. Press the Up (▲) or Down (▼) key until the desired temperature value appears in the left-hand display.

3. Press the **enter** key to save the setpoint.
   The temperature display will stop flashing, and the CO_2 display will flash.

4. Press the up (▲) or down (▼) key until the desired CO_2 value appears in the right-hand display.

5. Press the **enter** key to save the setpoint.

5.5 Referencing CO_2 with AutoZero

The purpose of the AutoZero system is to reference the CO_2 sensor to an atmospheric CO_2 level of 0.05 %. Over a period of time, the sensor baseline may drift, causing an inaccuracy in the CO_2 level at the programmed value.

We recommend that you AutoZero the CO_2 system:

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

To perform the AutoZero:

1. If you have not already done so, set the CO_2 level (see *Setting temperature and CO_2 on p. 21)*. There should be an audible click when the programmed level is entered: this is the CO_2 valve opening.

2. Press the ⬤ and **enter** keys simultaneously.

   ⓘ   There is a magnetic switch in the outer door, and a magnet mounted above the door, to switch off the CO_2 valve when the outer door is opened.

3. The outer door (and inner door, if present) must be opened and closed according to the displayed instructions, after which the process is completely automatic. Read the instructions that appear in the display; the inner door, if fitted, must also be opened and closed according to the displayed instructions.

4. Open the door for 60 sec to completely de-gas the chamber. A countdown is shown on the display.

5. When the display instructs you to do so, close the door. An automatic 10 min countdown will start, to allow the chamber conditions to recover and the CO_2 sensor signal to stabilize.

6. At the end of the countdown, the sensor signal will automatically be rereferenced. The incubator will reopen the CO_2 valve to allow the CO_2 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 CO_2 will restart.

The incubator is now ready for use.

5.6 Programming the alarm system
5.6.1 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.

5.6.2 Setting the CO_2 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 CO_2 Alarm, use the ▲ or ▼ key. The minimum setting is 0.5 % from setpoint.

5. Press the **enter** key to save the setting.
   The low CO_2 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 save the setting.

5.6.3 Door open alarm

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

1. Press the **Enter** and ▼ keys simultaneously to enter Alarm Program Mode.

    The display will show: *°C.AL*.

2. Press the ▲ key until the display shows *DOO R.AL* (reading across both displays).

3. 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*).

4. Press the **enter** key to save the desired value.

5.6.4 Alarm duration

Perform the following procedure to adjust the length of time during which all audible alarms will last:

1. Press the **enter** and ▼ keys simultaneously to enter Alarm Program Mode.

    The display will show: *°C.AL*.

2. Press the ▲ key until the display shows *PER .IOD* (reading across both displays).

3. 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*).

4. Press the **enter** key to select the desired value.

5.6.5 Alarm arming delay

This is the length of time that is allowed for the Temperature and CO_2 to recover after you open the incubator, and before the Alarm System is armed again. This helps prevent unnecessary alarms from occurring.

To change the delay:

1. Press the **enter** and ▼ keys simultaneously to enter Alarm Program Mode.

    The display will show: *°C.AL*.

2. Press the ▲ key until the display shows *DR .DEL* (across both windows).

3. 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*.

4. Press **enter** to select the desired value.

5. Press ⬤ to return to the main alarm programming menu, and press ⬤ again to return to the main display.

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

5.7 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 CO_2 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 inner door (if fitted) is opened, the Alarm System is disabled. When you close the outer door, the preset Alarm Arming Delay starts. When the delay time expires, the Alarm System is rearmed; if the temperature and/or CO_2 should fall below or rise above the alarm setpoints, the alarm will be activated. If chamber conditions recover within the Alarm Arming Delay time, the Alarm System will be rearmed 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 *Alarm duration on p. 23*).

5.7.1 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 F.AIL*.

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.

5.7.2 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 CO_2 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.

5.7.3 CO_2 control system alarm

This alarm only occurs if the CO_2 AutoZero cannot reference the sensor signal to atmosphere. If this is the case, at the end of the Auto-Zero procedure, the following message will appear: *CO2 AUTO ZERO FAI LED*. This means that the CO_2 sensor is defective and requires replacement.

If this alarm occurs, contact your service representative immediately.

5.7.4 Review of alarm messages

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

Alarm messages

Message	Meaning	Reference
door.AL	door open	(see *Door open alarm on p. 22*)
°CF AIL	temperature sensor failure	(see *Temperature sensor system alarms on p. 24*)
SAL	sensor alarm after sensor recovers	(see *Temperature sensor system alarms on p. 24*)
°Ct rip	over-temperature cut-out has cut power to heating elements and CO_2 valve	(see *Over-temperature cut-out and alarm on p. 24*)
TAL	over-temperature defect has occurred and system is under emergency control	(see *Over-temperature cut-out and alarm on p. 24*)
CO2 AUTO ZEr0 FAILEd	CO_2 sensor is defective and needs to be replaced	(see *CO_2 control system alarm on p. 25*)

5.8 RS-232 interface

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

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

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

Prerequisites
• A PC or terminal, capable of RS-232 communication, with one serial com port free for this connection or a serial interface box .
• A null-modem screened cable of suitable length. To ensure reliable communication, the cable should not exceed 15 m (49 ft) in length. One end must have a 9-pin female D connector, to connect to the incubator's RS-232 port, and the other end must have either a 9-pin or 25-pin female D connector, whichever mates to your PC or terminal .
• Suitable communications software, such as Eppendorf's BioCommand SFI or HyperTerminal (included with Windows® NT, 95, 98, ME, 2000 and XP).

The incubator requires the following settings in the communications software:

Tab. 5-3: Communication settings

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

To use the RS-232 interface:

1. Connect the null-modem cable to the RS-232 port at the rear of the incubator.
2. Connect the other end of the cable to either the 25-pin male D serial com port or the 9-pin male D serial com port on the PC or terminal.
3. Turn on the computer and start the communications software.
4. Select an unused serial port to enable communications between the incubator and the PC or terminal. If you know which port to use, continue to Step 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 Eppendorf's BioCommand SFI operating manual for instructions).

   If you have successfully chosen an unused port, the message Type *?* for help should appear on the computer screen.
6. If you see any other message, or nothing happens, select the next port and press the *ENTER* key again. If you still do not see the expected message, change the *Flow Control* setting from *Hardware* to *None*, then try again.
7. When the connection between the incubator and PC/terminal has been successfully established, and the message indicated in Step 5 appears, type (as prompted by the message onscreen) a ? in the communications software, then press the *ENTER* key.
8. This menu will appear on the computer screen:
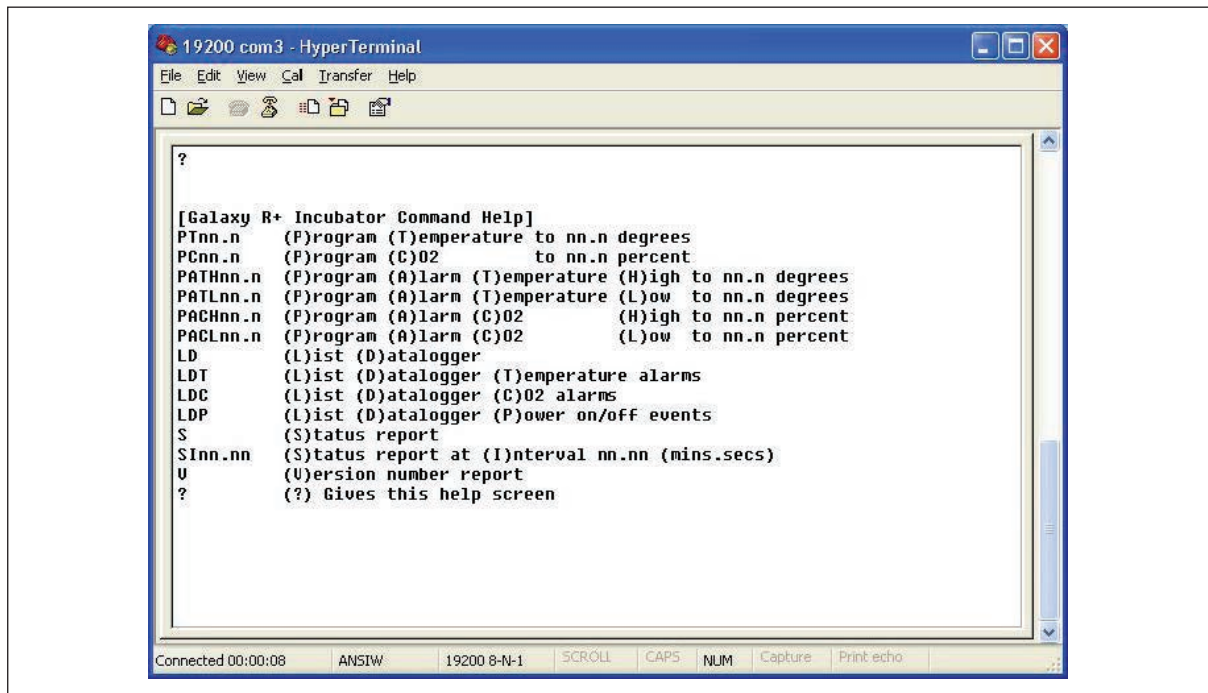
This menu allows the incubator temperature, CO_2 and alarm setpoints to be programmed remotely. A running status report can be generated at user-defined intervals, and all reports can be sent to a printer. For details on these features, consult the documentation supplied with your communications software.

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

Tab. 5-4: Remote programming

PTnn.n	(P)rogram new (T)emperature setpoint. Type *PT37.5*, then press *ENTER* to reprogram the incubator's temperature setpoint to 37.5 °C.
PCnn.n	(P)rogram new (C)O$_2$ level. Type *PC04.0*, then press *ENTER* to reprogram the incubator's CO_2 level to 4 %.
PATHnn.n	(P)rogram new (A)larm (T)emperature (H)igh setpoint. Type *PATH38.0*, then press *ENTER* to reprogram the incubator's high temperature alarm setpoint to 38.0 °C.
PATLnn.n	(P)rogram new (A)larm (T)emperature (L)ow setpoint. Type *PATL36.0*, then press *ENTER* to reprogram the incubator's low temperature alarm setpoint to 36.0 °C.
PACHnn.n	(P)rogram new (A)larm (C)O$_2$ level (H)igh setpoint. Type *PACH05.5*, then press *ENTER* to reprogram the incubator's high CO_2 level alarm setpoint to 5.5 %.
PACLnn.n	(P)rogram new (A)larm (C)O$_2$ (L)ow setpoint. Type *PACL04.5*, then press *ENTER* to reprogram the incubator's low CO_2 level alarm setpoint to 4.5 %.

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

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

Tab. 5-5: Status commands

S	(S)tatus report. Type *S*, then press the *ENTER* key to display a current status report, which may look like this: *Temperature: Actual 37.0 °C Setpoint 37.0 °C* *CO_2: Actual 05.0 % Setpoint 05.0 %*
SInn.nn	(S)tatus report at (I)nterval of n minutes, n seconds. Type *SI60.0*, then press the *ENTER* key to display a current status report (as shown above) every hour. A confirmation message will appear: *Status report at interval 60.0 will be given* *Press "Enter" or "ESC" to stop reports*

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

Tab. 5-6: Other commands

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

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

Tab. 5-7: Messages

Type of Message	Message
Alarm	*TEMPERATURE LOW*
Alarm	*TEMPERATURE HIGH*
Alarm	*CO_2 LOW*
Alarm	*CO_2 HIGH*
Alarm	*TEMPERATURE SENSOR FAILURE*
Alarm (AutoZero)	*PROG CO_2 A/Z SYSTEM INOPERATIVE*
AutoZero Event	*PROG CO_2 A/Z COMPLETED OK*
Door Event	*DOOR OPENED*
Door Event	*DOOR CLOSED*

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

[DOOR EVENT] DOOR OPENED

Temperature: Actual 37.0 °C Setpoint 37.0 °C

CO_2: Actual 00.1 % Setpoint 05.0 %

5.9   Operation for optional features

For functionality on optional features (see *Options and accessories on p. 41)*.

6 Maintenance

6.1 Routine maintenance

6.1.1 General

To ensure that chamber conditions remain as stable as possible, minimize the length of time that the inner door (if fitted) or outer door is open.

> 🛈 An inner door (optional) is recommended to maintain the chamber conditions stable and to conserve gas.

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, be sure to follow the indications provided (see *Using the humidity tray on p. 20)*.

> 🛈 There is no need to remove the top panel for normal maintenance or servicing, so if you have two incubators stacked, the upper incubator does not have to be moved when you are servicing the lower incubator.

6.1.2 Daily Checks

1. Check that the temperature and CO_2 levels are reading within specification.

2. Check the reserve pressure in the CO_2 cylinder (normally 725 psi (50 bar) when full). The design of the incubator ensures very low consumption of CO_2: during normal working conditions, a typical large cylinder should last approximately 12 months. If there is a significant drop in the cylinder pressure from 725 psi (50 bar), it means that the cylinder is almost empty and should be replaced. Ensuring that there are no leaks at any of the connections will ensure a greater lifetime to the CO_2 supply and will help avoid accidentally running out of CO_2.

3. Any spills in the chamber should be cleaned immediately to protect the stainless steel surfaces.

6.1.3 Monthly checks

1. Refill the humidity tray (to a maximum volume of 0.3 L). The use of warm distilled water (~37.0 °C) will ensure a rapid return to optimum chamber conditions. After refilling, check that the humidity tray is situated between the shelf rack supports.

2. If required, you can take a sample of the gas inside the chamber using the CO_2 sample port, and check it using a CO_2 gas analyzer. The CO_2 sample port is located on the lefthand side of the rear panel (see Fig. 4-5 on p. 16).

If you conduct a sampling, please take the following precautions:
- Turn off the CO_2 gas by reprogramming the setpoint for CO_2 to 0.0 % to prevent CO_2 from being injected into the chamber, which would give a false reading.
- Use a flow rate ≤0.5 liters/minute to take the sample.
- Keep the outer door closed.
- Remember to reset the CO_2 setpoint to the desired level after sampling.

We recommend that you perform a CO_2 AutoZero prior to sampling (see *Referencing CO_2 with AutoZero on p. 21)*.

3. We also recommend that you AutoZero the CO_2 system once a month to ensure that the CO_2 level is correct.

6.2 Cleaning

DANGER! Electric shock

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

NOTICE! Risk of damage to device

▸ Be sure to use only approved cleaning fluids and materials. Solvents, chlorine salts, chloride-based cleaning substances, and abrasive materials, among others, may cause permanent damage to the product surfaces. Also be sure to wipe all surfaces dry, leaving them free from any foreign particulates or fluids which could cause subsequent surface damage.

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.

6.3 Disinfection/Decontamination

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.

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.

⚠️ **CAUTION!**

- ▸ As a routine precaution, wear protective gloves.
- ▸ Be sure to adequately ventilate the work area as you are disinfecting, to avoid the formation of potentially explosive alcohol vapors.
- ▸ Protect all electrical connections from contact with the alcohol solution.

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

1. Program 0.0 % CO_2 and switch off the incubator. Unplug the incubator from the mains/power supply.

2. Dampen a clean cloth with the alcohol solution and wipe down all external surfaces, taking care to keep the alcohol solution from coming into contact with any mains/electrical outlets or assemblies.

3. Remove all of the shelves, the humidity tray, and the shelf racks.

NOTICE! Risk of material damage

- ▸ It is very important to ensure that no liquid is spilled onto the white porous CO_2 sensor cover at the rear of the chamber. Failure to use the protective cover could result in damage to the sensor and may affect your warranty.

4. Place the black protective cover over the CO_2 sensor.

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.

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 or Sulphuric Acid.

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.

9. Be sure to remove the protective cover from the sensor and put it back in the holder for safekeeping.

10. When you reinstall it, ensure that the humidity tray is centered between the shelf rack supports. Refill the humidity tray (see *Using the humidity tray on p. 20)*.

11. Leave the incubator on for at least two hours (preferably overnight) to allow conditions to stabilize.

12. When the incubator has stabilized, carry out an AutoZero and reprogram the desired CO_2 level.

7 Transport, storage and disposal

7.1 Storage

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

7.2 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 2002/96/EC pertaining to waste electrical and electronic equipment (WEEE).

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

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

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

8 Technical data

ⓘ Factory calibration of the incubator is carried out at 37 °C, 5.0 % CO_2 with humidification, in an ambient temperature of 20 – 25°C with no heat generating apparatus inside the chamber. Software calibration adjustments may be required to optimize performance if the incubator is being used well outside these operating conditions. Performance specifications may also be affected.
For advice on calibration adjustments and relevant performance specifications, contact Eppendorf. Please be prepared with the model and serial number of your incubator and the complete details of your operating conditions.

8.0.1 Temperature

Digital programming via microprocessor control in 0.1 °C increments. Measurement of chamber, outer door and both heating element temperatures via 4 resistance temperature curve matched thermistors (sensitivity 0.01 °C).

"Out of Limits" temperature protection system independent of microprocessor control.

Range	4 °C above ambient temperature[1] to 50 °C
Control	± 0.1 °C
Stability	± 0.1 °C
Uniformity	± 0.3 °C
Storage temperature	10 – 50 °C

[1] If the incubator is to be run close to ambient temperature, it may be necessary to make some adjustments to the control parameters to avoid temperature overshoot.

8.0.2 CO_2 Control

Solid-state infrared CO_2 sensor operating independent of humidity. Semi-automatic CO_2 zeroing facility.

Range	0.2 – 20 %
Control	±0.1 %
Stability	±0.2 %
Uniformity	±0.1 %
Gas connections	6 mm (~1/4 inch) tubing
Required gas pressure	0.35 bar (5 psi)

8.0.3   Relative humidity

Removable stainless steel humidity tray.

Reservoir capacity	0.3 L (fill to 0.2 L)
Humidity control	Minimum of 90 %

8.0.4   Altitude

Up to 2000 m.

8.0.5   Shelves

Stainless steel, non-perforated (standard).

Capacity	405 cm² per shelf
Number of shelves	2 standard; with multiple position option, up to 4 shelves

8.0.6   Alarm systems

Two-level alarm system giving programmable audio/visual warnings with options for remote communication. Level 1 signals system failures; level 2 is programmable and monitors chamber conditions.

8.0.7   Dimensions

External	Width: 31.3 cm (12.3 in)
	Height: 45.4 cm (17.9 in)
	Depth: 28.5 cm (11.2 in)
Chamber	Width: 23.3 cm (9.2 in) Height: 29.4 cm (11.6 in) Depth: 20.8 cm (8.2 in)
External, crated	Width: 40 cm (15.75 in)
	Height: 61 cm (24.0 in)
	Depth: 59 cm (23.4 in)
Chamber Volume	14 L

8.0.8   Weight

Crated	18.5 kg (40.8 lb)
Uncrated	~12.5 kg (27.6 lb) (with standard features)

8.0.9 Grounded electrical supply

Voltage	110 – 120 V 50/60 Hz or 220 – 240 V 50/60 Hz
Power consumption for standard models	900 W
Energy to maintain 37 °C	< 0.06 kWh (at room temperature between 20 – 25 °C)

9 Options and accessories

Some combinations of options may not be possible. Others may add extra cost. Please contact Eppendorf for ordering information.

Option
Oxygen control (1 – 19 %)
BMS alarm relay contact

9.1 O$_2$ control (1 - 19 %)

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

9.1.1 Setting up the N$_2$ tank

Prerequisites

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

- 2 cylinders of nitrogen, regulation size W
- 1 two-stage pressure regulator
- 1 Inline pressure regulator
- 6 mm PVC tubing
- tubing clips

Set up the nitrogen tanks as follows:

1. Inspect the tanks to ensure 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 N$_2$ inlet on the lower lefthand side of the equipment tray as you face the rear panel; secure both ends with clips.

   ⓘ   To add an automatic gas cylinder changeover instrument: with the incubator turned off, connect its inlet to the two-stage pressure regulator's outlet, and the changeover instrument's outlet to the inline pressure regulator's inlet with tubing, securing the ends with tubing clips.

9.1.2   Setting up oxygen control

1. Remove the red plastic protective cover from the hydrophobic filter cap (making sure that the hydrophobic filter cap is not removed with it), located in the rear wall of the incubator chamber. Retain the cover for use when you clean the chamber.

2. Open the nitrogen gas supply from the tank. Set the N_2 tank's outlet pressure gauge to 1.5 bar.

3. Set the nitrogen regulator to 0.35 bar (5 psi). The nitrogen will be fed into the incubator through filter that is already installed in the gas line. The gas flow rate is approximately 20 L/min.

    > **i**   If the programmed O_2 level is close to the ambient oxygen, it may be necessary to reduce the cylinder pressure below 1 bar to stop the oxygen level from undershooting the programmed value.

4. After the incubator has been humidified and left overnight to stabilize, the oxygen sensor should be referenced to atmosphere (see *Referencing to atmosphere on p. 43)*.

5. Enable the oxygen control: (a) enter the *02.cont* menu by pressing and holding the ▲ key, then pressing the ● key; *02.cont* should appear on the display (if it does not, press the ▲ or ▼ key until it appears); now press the **enter** key; (b) using the ▲ or ▼ key, select *On* or *OFF* to enable or disable oxygen control; (c) press the **enter** key to store the change; (d) press the ● key repeatedly until you return to the Main screen.

6. Program the required oxygen level: (a) from the Main menu, press the ● key, then press the **enter** key twice; the screen should display *02 .19.0* and the 19.0 should be flashing; (b) now use the ▲ or ▼ key to set the desired oxygen level; (c) press the **enter** key to store the change.

    > **i**   The oxygen alarm levels are set automatically to ±0.5% of the programmed value, but you can modify them in the alarm menu, as explained in Step 7:

7. To set the oxygen alarm levels: Set the oxygen level alarms: (a) press and hold the ▼ key and press the **enter** key to enter the alarm menu; (b) use the ▲ or ▼ key to scroll through the menu until *02 . AL* is displayed, then press the **enter** key. (c) The High alarm is displayed first; use the ▲ or ▼ key to set the desired alarm level, then press the **enter** key to store the change; (d) the Low alarm is now displayed; use the ▲ or ▼ key to set the desired alarm level, then press the **enter** key to store the change.

    > **i**   The alarm values cannot be set to less than 0.5% of the programmed value.

    > **i**   When using the incubator at low oxygen levels, it is possible that the CO_2 and O_2 levels may not fully recover within the default alarm limit of 15 minutes after the door was opened. This alarm delay time period can be modified in the alarm menu: (a) enter the alarm menu as indicated in Step 7 above; use the ▲ or ▼ key until *dr . dEL* is displayed; (b) press the **enter** key; (c) use the ▲ or ▼ key to increase the door delay value; (d) press the **enter** key to store the change; (e) press the ● key repeatedly until you return to the main screen.

8. By finely adjusting the CO_2 and N_2 gas inlet pressures, oxygen control can be tailored to achieve the programmed oxygen and carbon dioxide levels at approximately the same time.

9.1.3   Operating guidelines

We recommend that you reference the oxygen sensor to atmosphere (see *Referencing to atmosphere on p. 43)* once a month to ensure that any long-term drift in sensor output will be corrected. Be sure to do it at the chamber operating temperature.

When you are cleaning the chamber, be very careful not to wet the oxygen sensor or CO_2 sensor. Never use solvents on the sensor membrane; rather, be sure to cap the hydrophobic filter before you clean. In fact, 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 (ambient up to 95 %), 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:

- 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(s). The humidity tray can then be reinstalled and the incubator can be safely re-humidified.

9.1.4   Referencing to atmosphere

The oxygen sensor is a self-powered electrochemical cell that has a finite life 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 unusable. For this reason, we recommend that you reference the sensor to atmospheric oxygen levels on a monthly basis.

The sensor is automatically referenced to atmospheric oxygen levels when you enter the oxygen control menu. To do this:

1. First, make sure the incubator has been humidified and left overnight to stabilize.

2. Hold the ▲ key, then press the ⬤ key; the display will read *02.cont.*

3. Press the ▲ key until the display reads *O2 . rEF*, then open the incubator door.

4. The display will begin a 60 second countdown timer (*cd . 59*, *cd . 58*, *cd . 57*, etc.). When the countdown period has elapsed, close the incubator door.

5. The oxygen control system will allow the oxygen sensor to stablize for ten minutes after the door is closed. Once it has stablized, the control system will reference the sensor to atmopheric oxygen level. The reading is automatically adjusted to 19.7 %, which is the true reading taking into account the relative humidity in the chamber.

During the oxygen sensor reference to atmosphere procedure, the control system measures the sensor output to estimate the remaining sensor life. There are three possible outcomes. The first is that the referencing procedure was successful, and no further action is needed. In this case, the following scrolling message will be displayed: *OXY.gEn Sen.Sor OK*, then *O2.ref* in ran.ge.

The the other possible outcomes are:

- *o2.ref sensor nea.r end.of life but.is in. ran.ge*
- *o2r.ef fai.led sensor at. end.of lif.e o2. con.trl off.*

9.1.5   Replace sensor soon

If the referencing procedure was successful but the sensor is nearing the end of its working life, the following scrolling message will be displayed: *o2.ref sensor nea.r end.of life but.is in. ran.ge*

In this case, the sensor will need to be replaced soon (see *Removing and replacing 0_2 sensor on p. 44*).

9.1.6   Replace sensor now

If the referencing procedure failed, oxygen control will automatically be disabled until a new sensor is installed and correctly referenced to atmosphere. The following scrolling message will be displayed: *o2r.ef fai.led sensor at. end.of lif.e o2. con.trl off.*

If the sensor fails the referencing procedure, first repeat the procedure to confirm the result. Then remove and replace the sensor.

9.1.7   Removing and replacing 0_2 sensor

To remove and replace the oxygen sensor, you will need the sensor removal tool provided.

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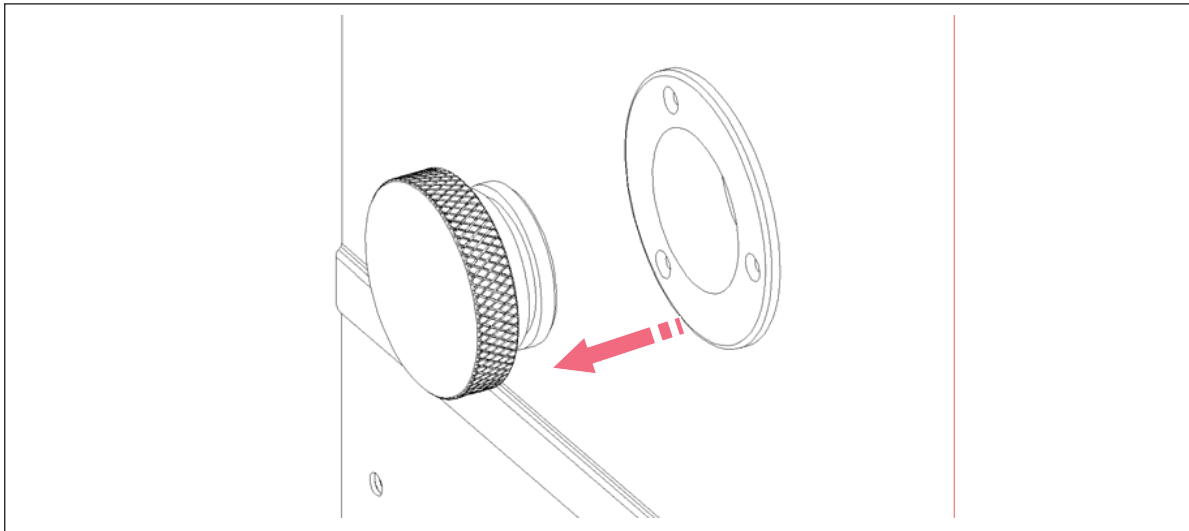

Fig. 9-1:   Oxygen sensor rear access cover

> ⚠ **WARNING!**
>
> ▸ Never pull on the wire leads; disconnect the white connector body.

2. Reach inside and disconnect the sensor by unplugging the connector: *be sure to grasp the white connector body, not the wire leads!*

3. Using the sensor removal tool (see following Figure), unscrew the oxygen sensor by turning it counter-clockwise. Because the oxygen sensor contains lead, be sure to dispose of it according to local regulations.
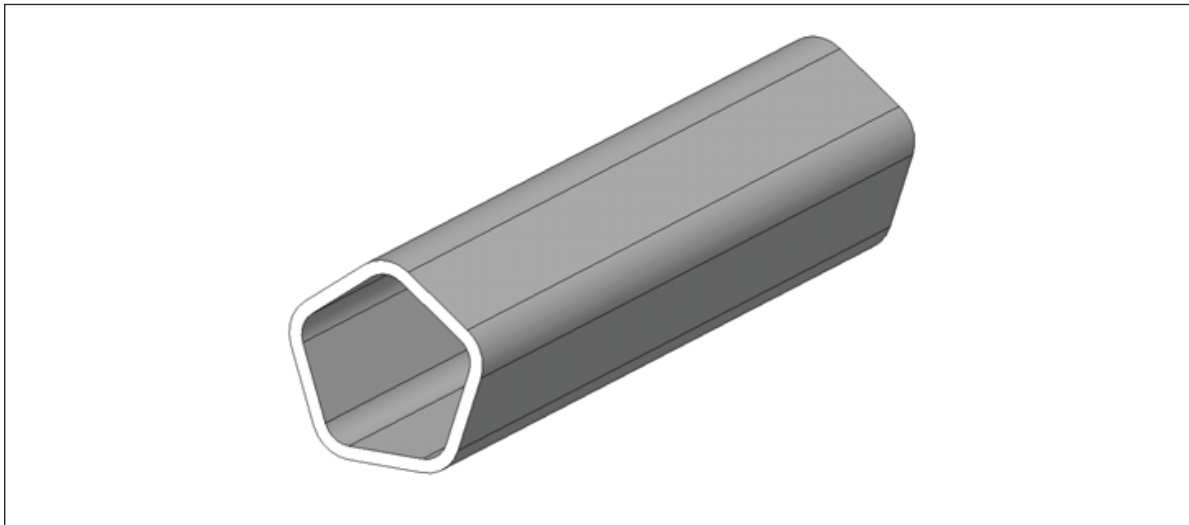

Fig. 9-2:   Oxygen sensor removal tool

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.*

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. 43)*.

9.1.8   Replacing the filter disc

The hydrophobic filter installed on your Oxygen Control system helps prevent condensation from reaching the sensor (see following Figure).
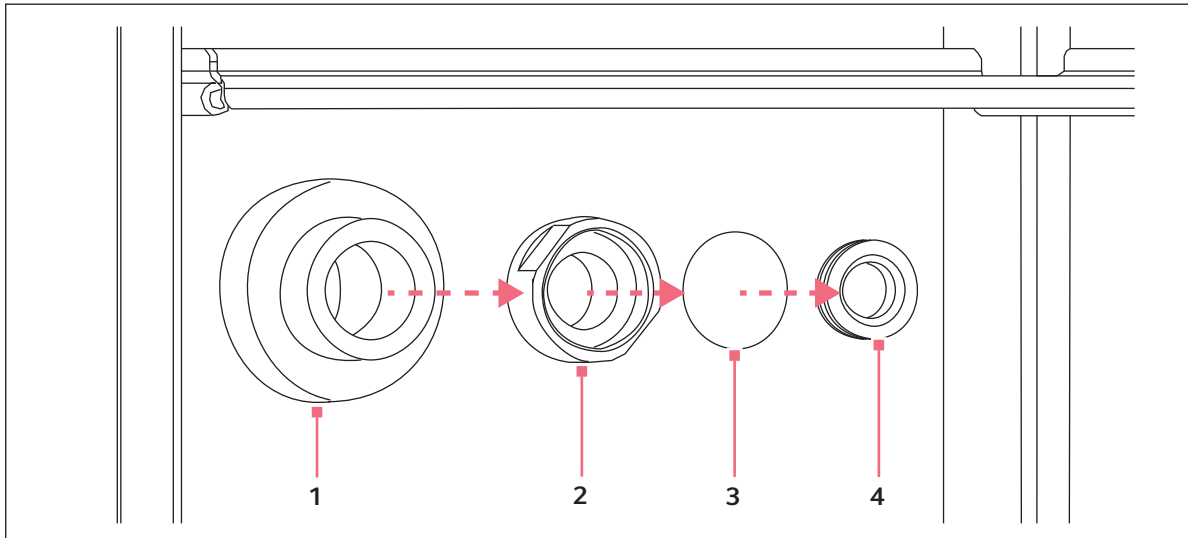
Fig. 9-3:   Hydrophobic filter and holder assembly (exploded view)

1 Oxygen sensor holder (on rear wall of incubator)

2 Hydrophobic filter holder (screws into sensor holder)

3 Hydrophobic filter disc

4 Hydrophobic filter cap

To replace the hydrophobic filter disc (membrane):

1. Carefully unscrew the hydrophobic filter holder from the oxygen sensor holder on the rear wall of the chamber.
2. With a fingertip or a 13 mm (0.5 inch) 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.
5. Make sure the O-rings (between the cap and filter holder and between the filter holder and oxygen sensor holder) are undamaged and securely in place.
6. Gently press the filter cap back in.
7. Carefully screw the hydrophobic filter holder back into the oxygen sensor holder.

9.1.9   Troubleshooting the oxygen sensor

If the oxygen sensor fails suddenly, it is very likely that the sensor inlet membrane has become blocked by condensation.

To dry the membrane:

1. Remove the hydrophobic filter holder assembly 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 or so. The oxygen level should rather suddenly recover after a few hours.
6. Leave the incubator for a few more hours to be sure that the sensor membrane has thoroughly dried out.
7. Replace the hydrophobic filter disc (see *Replacing the filter disc on p. 45)*.
8. Re-humidify the incubator.
9. After 2 or 3 hours, reference the oxygen sensor to atmosphere (see *Referencing to atmosphere on p. 43)*. When the referencing has been successfully completed, the incubator is ready for use.

9.1.10   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	5 psi
Typical Oxygen Reduction Rates	3 minutes to 16 % 4 minutes to 11 % 8 minutes to 6 %

9.2   BMS relay contact alarm

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

The following alarm conditions will activate the system: over-temperature, under-temperature, system failure, CO_2 high and CO_2 low.

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

The system is connected low at the middle of the equipment tray, as you face the rear panel, via a standard 6-pin DIN socket (see following Figure). The matching plug is provided, when the option is installed, in the accessories bag.
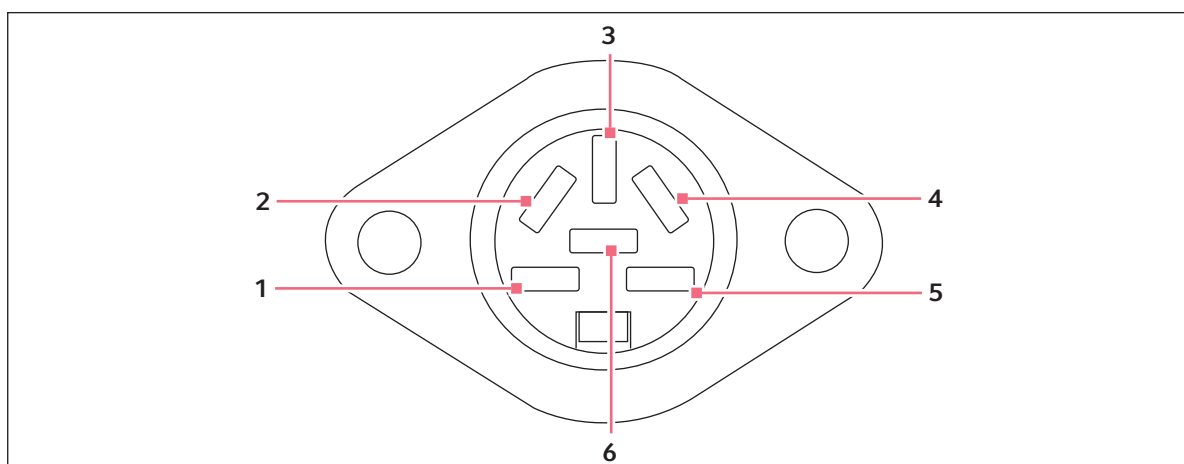
Fig. 9-4:   BMS relay contact alarm socket

Pin		Designation
1	12 V DC unregulated	To power external equipment such as a remote buzzer or light (100 mA maximum current available).*
2	0 V	
3	5 V DC	Via 10 K Ω pull-up resistor, for a logic signal to directly control an auxiliary control system.*
4	Normally closed	To access the relay contacts. Contact limits are 3 A @ 24 V DC and 3 A @ 34 V AC.
5	Common	
6	Normally open	

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

To turn the BMS relay contact alarm option **ON**:

1. Press the **enter** and ▼ keys simultaneously to enter the alarm menu.
2. Press the ▲ key until *rel.ay* is shown in the display.
3. Press the **enter** key to select this option.
4. The default setting is **OFF**, which reads *nO* in the display. Press the ▲ key to change the display to *yes* (ON). To deactivate the option, you can press the ▼ key to return the display to *nO* (OFF).
5. Press the **enter** key to accept the selection.

6. To return to the main (temperature and CO_2) display screen, press the ⬡ key twice.

9.3   Available accessories

Accessory	Part number
CO_2 Cylinder Automatic Change-Over Controller	P0628-5000
CO_2 Two Stage Regulator	P0628-5010
CO_2 Supply Line Filters	P0628-5020
In-Line Pressure Regulator	P0628-5030
Replacement O_2 sensor	P0628-5790
Electronic CO_2 Gas Analyzer	P0628-6150
Stacking Bracket For 2 incubators (prevents accidental tipping)	P0628-6230
Extra Shelf, Non-perforated	P0628-6180
Extra Humidity Tray, 0.3 liter	P0628-6200
Multi-Position Wire Shelf Racks (4-position)	P0628-6170
Inner Glass Door	P0628-6210
Electronic CO_2 and O_2 gas analyzer	P0628-6831
Electronic CO_2, O_2 and RH gas analyzer	P0628-7890

10 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® 14 S

including accessories

Product type:

CO_2 Incubator

Relevant directives / standards:

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

2004/108/EC: EN 61326-1

2011/65/EU

Management Board

Portfolio Management

Date: November 28, 2013

Your local distributor: www.eppendorf.com/contact
Eppendorf AG · 22331 Hamburg · Germany
eppendorf@eppendorf.com

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