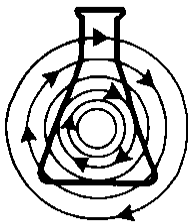




Guide to Operations

Excella[®] ECO-170 CO₂ Incubator

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Revision A
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**CAUTION!**

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

Please read the entire User's Guide before attempting to use this unit.

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

New Brunswick Scientific Co., Inc. (NBS) is not responsible for any damage to this equipment that may result from the use of an accessory not manufactured by NBS.

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Manual Conventions



NOTE:

Notes contain essential information that deserves special attention.



CAUTION!

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



WARNING!

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

Bold

Text in boldface type emphasizes key words or phrases.



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



CRUSH WARNING!

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



WARRANTY

Every Instrument manufactured by the New Brunswick Scientific Co., Inc. is warranted to be free from defects in material and workmanship. This apparatus, with the exception of glassware, lamps and electrodes (where supplied), is warranted for 1 year against faulty components and assembly and our obligation under this warranty is limited to repairing or replacing the instrument or part thereof, which shall within 1 year following date of shipment prove to be defective after our examination.

This warranty does not extend to any NBS products which have been subjected to misuse, neglect, accident or improper installation or application; nor shall it extend to products which have been repaired or altered outside the NBS factory without prior authorization from the New Brunswick Scientific Co., Inc.

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1 INTRODUCTION

The Excella[®] model ECO-170 CO₂ incubator is microprocessor-controlled and designed to ensure accurate and reliable operation. The unit incorporates a simple, door-mounted touch-sensitive keypad with two individual three-digit LED displays that allow for easy programming and monitoring of the chamber conditions.

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. This system ensures a rapid, controlled return to optimum chamber conditions after a door opening while also preventing any overshoot.

A solid-state infrared sensor is used to control the level of CO₂, providing excellent reliability and remaining unaffected by humidity.

The 170-liter chamber is seamless to provide a sanitary and easy-to-clean environment, and all internal components are manufactured from polished stainless steel. The non-tip shelves, shelf racks and humidity tray are easily removed without tools for thorough cleaning and are 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 zinc-plated stove enameled steel to give a durable corrosion-resistant finish.

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

The incubator'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.

2 UNPACKING & INSTALLATION

2.1 Inspection of Boxes

After you have received your order from New Brunswick Scientific, inspect the boxes carefully for any damage that may have occurred during shipping. Report any damage to the carrier and to your local NBS Sales Order Department or distributor immediately.

2.2 Unpacking

**WARNING!**

At least two people are required to safely lift your ECO-170.

Disassemble the wooden shipping crate and remove the protective packing. Save the packing materials for possible future use, and be sure to save this User's Guide for instruction and reference.

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

Locate and remove the parts stored in the Humidity Tray.

If any part of your order was damaged during shipping, is missing, or fails to operate, please fill out Customer Satisfaction Form 6300 (packed in the envelope with your warranty card) and return it by fax or mail. You can also call New Brunswick Scientific's or your distributor's service department.

Using your NBS packing list, verify that you have received the correct materials, and that nothing is missing.

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

Table 1: Accessories Provided

Quantity	Item	Notes
4	Non-tip Shelves	Packed Separately
2	Wire Shelf Racks (one for each side)	Packed Separately
1	Humidity Tray	Packed Separately
1	White porous CO ₂ Sensor Cover	Installed
1	Black CO ₂ Sensor Cover	Installed
1	Power Cord	Packed in Humidity Tray
3 meters, 9.8 feet	PVC Tubing, ~1/4-inch or 6mm bore, with an inline CO ₂ HEPA-filter connected, ready for use	Packed in Humidity Tray
2	Hose Clips	Packed in Humidity Tray
4	Adjustable Feet, with locking nuts	Packed in Humidity Tray
4	Anti-slip Pads for adjustable feet	Packed in Humidity Tray
1	User Manual	Supplied

2.3 Utilities

In order to use the incubator, you will need:

Table 2: Utilities

Utility	Requirement
Electricity	110/120V, 50/60 Hz grounded electrical supply with min. capacity of 6 amps
	OR
	220/240V, 50 Hz grounded electrical supply with minimum capacity of 3 amps
CO ₂ Gas	Cylinder with 100% CO ₂ vapor withdrawal, together with a two-stage regulator for pressure control to 5 psi or 0.35 BAR

2.4 Location

The incubator is designed to operate at a chamber temperature of 1.0°C above ambient, and at an absolute minimum ambient temperature of 15°C if the unit is being used at 37°C. Care should be taken to avoid placing the incubator in a position that may affect its performance, such as those listed below.

DO NOT place the incubator:

- **Directly under, beside or within the air-flow of heating or air-conditioning ducts, or other drafts;**
- **Directly beside heat generating equipment such as a heater, an autoclave or oven;**
- **Near the exhaust of heat- or cold-generating equipment (like a ULT freezer);**
- **Near a window exposed to direct, unshaded sunlight.**
- **Directly on top of any heat-generating apparatus.**

Remove the unit from the pallet and place the incubator in the working position, on a level surface capable of bearing its weight (approximately 165 lbs./75 kg; actual use weight will be heavier and will depend on the options installed and the material stored in the incubator).

The incubator is designed so that one incubator can be safely stacked on top of another identical unit. 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 ECO-170.

 **NOTE:**

There is no need to remove the top panel for normal maintenance or servicing, so the upper unit does not have to be moved when you are servicing the lower unit.

2.5 Installing the Feet

To ensure adequate airflow for correct operation of the relative humidity control system, the incubator feet *must* be installed. More than one person is required to perform this operation.

To insert the adjustable feet:

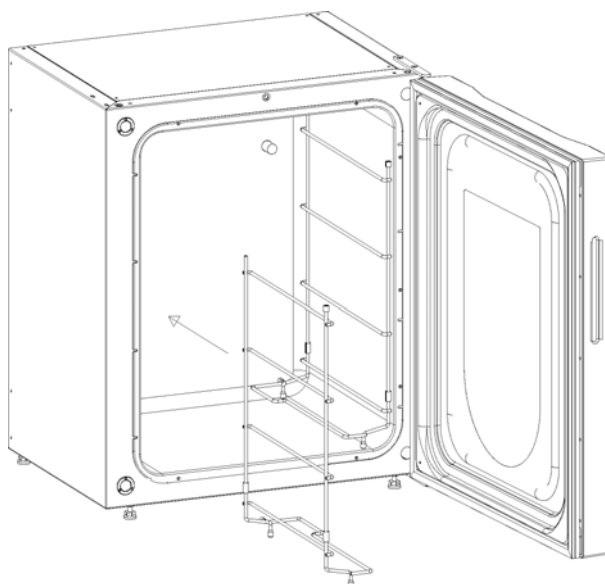
1. Make sure the locking nuts are installed onto each of the four feet provided.
2. Beginning with the front pair: tilt the incubator toward the back, and screw the feet in, to the required depth.
3. Tilt the incubator forward to install the rear pair of feet.
4. Put an anti-slip pad (provided) on each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

If you are installing the optional rear castors, this would be a good time to install them in place of the rear feet.

2.6 Setting Up

Install the wire shelf racks and shelves, and level the incubator:

1. *Oriented as shown in Figure 1 on the following page*, place the shelf racks inside the chamber. Each rack has three rubber feet: two stand on the floor of the chamber, and one stands against the back wall. Make sure the cushioned tubing spacers are snug against the side walls; these spacers allow clearance for the shelves.

Figure 1: Inserting Shelf Racks

2. Install the tie rod at the back of the shelves to hold both sides together, as shown in Figures 2 & 3. You may prefer to do this prior to inserting the racks in the chamber.

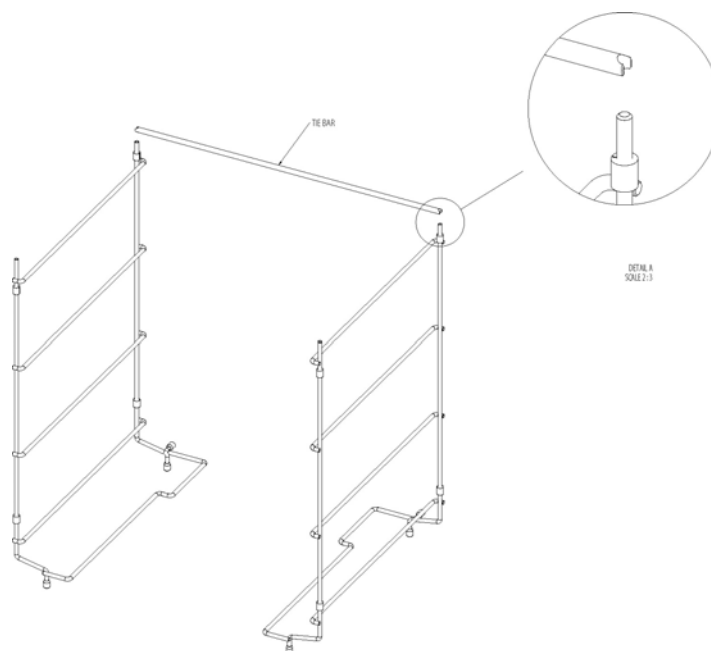
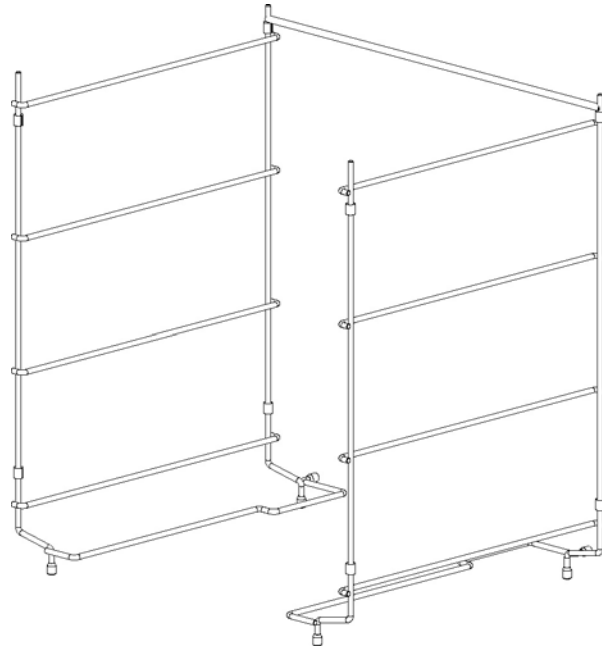
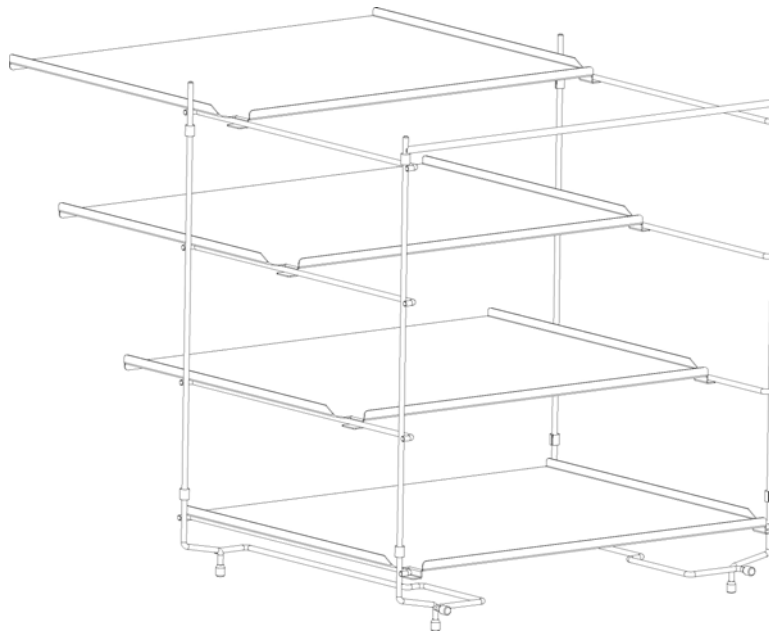
Figure 2: Fitting Tie Bar to Shelf Racks

Figure 3: Shelf Rack Assembly

3. Install the 4 shelves (*see Figure 4*), beginning at the top. Make sure that each shelf's anti-tip groove is properly inserted onto each of the shelf rack guides.

Figure 4: Inserting Shelves (as seen from the back)

4. 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 feet in place by tightening the locking nuts on each foot.

5. Slide the humidity tray onto the lowest shelf rack supports, which are shaped with stops to keep the tray in place (see *Figures 5 & 6*).

Figure 5: Installing the Humidity Tray

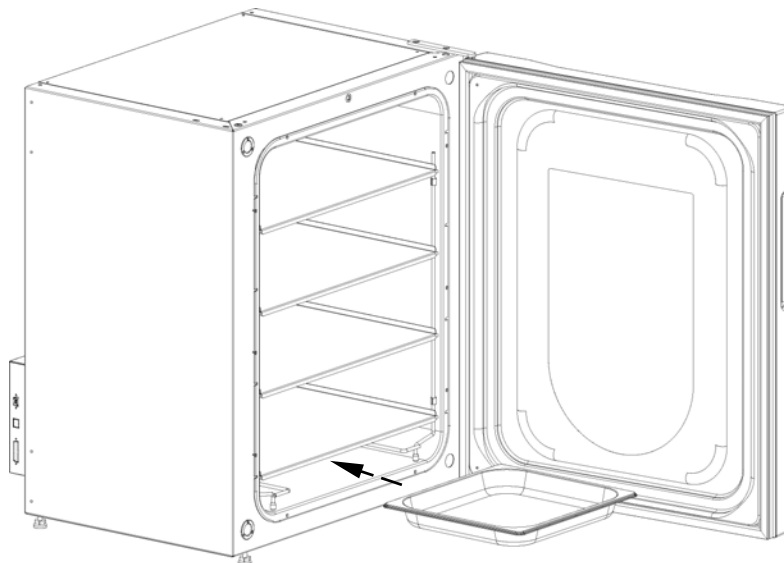
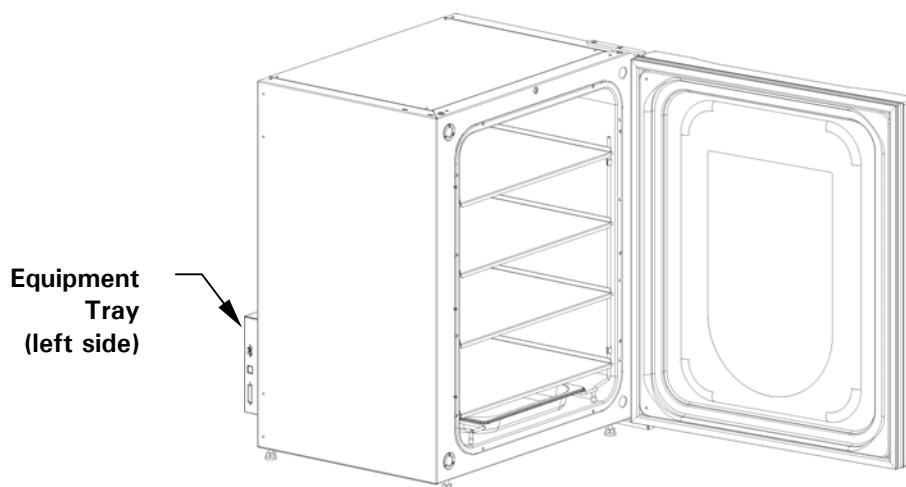


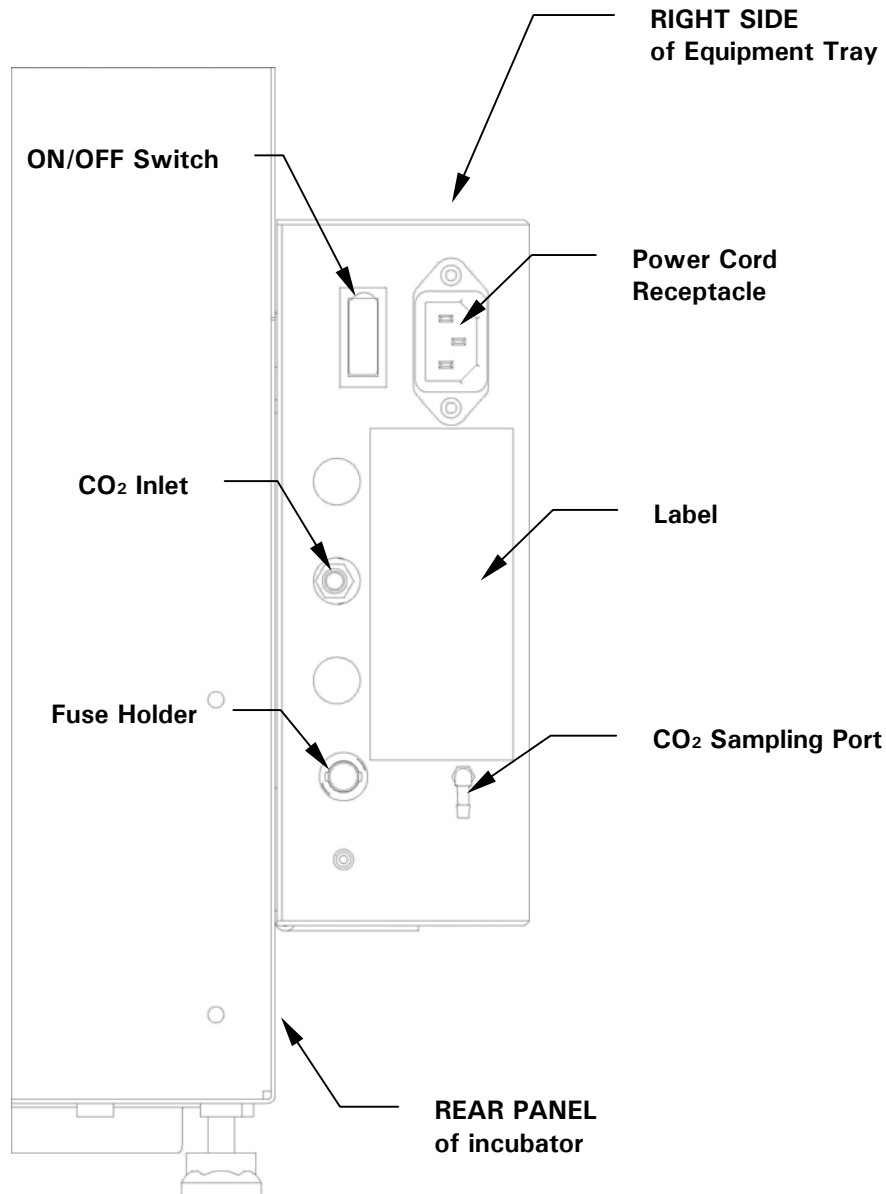
Figure 6: Humidity Tray, Installed



2.7 Making Connections

Connect the CO₂ gas supply:

1. Connect the unit to the CO₂ supply using the ~1/4-inch or 6mm plastic tubing (with installed HEPA filter) by attaching the tubing from the two-stage regulator (or in-line regulator) to the matching CO₂ inlet on right side of the equipment tray (see *Figure 7 on the following page*).

Figure 7: Making Connections

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

**WARNING!**

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

Install the power cord:

1. Insert the power cord into its receptacle on the right side (facing the unit) of the equipment tray (*see Figure 7 on the previous page*).
2. After verifying that your supply voltage matches the voltage specified for your incubator and that the ON/OFF switch is OFF, plug the cord into your power supply outlet.

3 OPERATION

3.1 Control Panel

The control panel consists of two individual three-digit LED displays, and four Function keys (see *Figure 8 below*).

Figure 8: Control Panel



Table 3: Function Keys

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

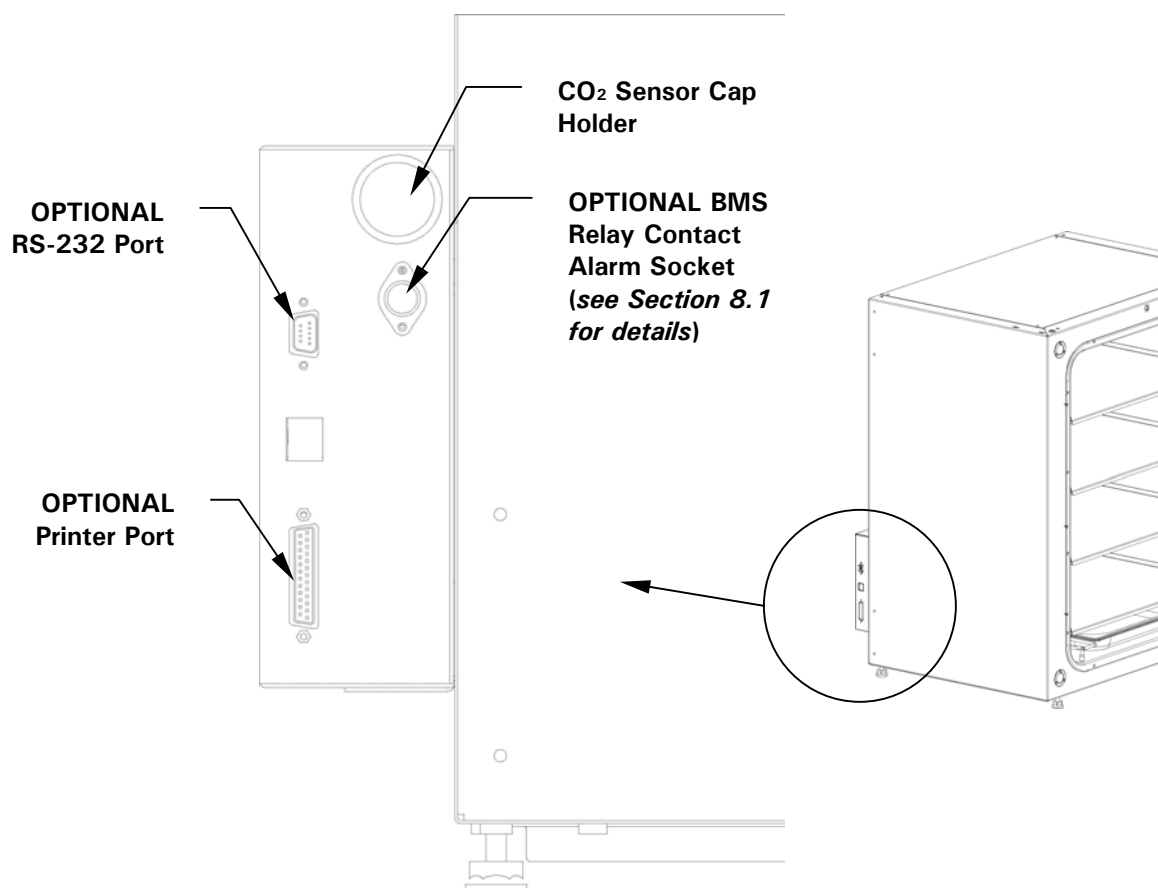
 **NOTE:**

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

3.2 Preparing for Operation

1. Remove the black protective cover from the CO₂ sensor, and store it for use when you clean the incubator. There is a storage holder on the left side of the equipment tray (see Figure 9 below).

Figure 9: CO₂ Sensor Holder



2. Ensure that the white porous sensor cover is in place.
3. Remove the silica gel dessicant sachet.
4. Using the power cord provided, connect the incubator to a grounded power supply.
5. Turn on the incubator; the display will illuminate. Humidifying begins when the temperature reaches the programmed level.

 **NOTE:**

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 CO₂ flash on and off to signify that the Alarm System is not armed.

6. Turn on the gas supply with the pressure set to 5 psi or 0.35 bar when the incubator is at the programmed temperature.

**NOTE:**

CO₂ will not come on until the programmed temperature has been reached.

Ensure gas supply connections are secure: gas leaks not only affect performance, they will also deplete the gas supply.

7. The chamber setpoints are pre-programmed at 37.0°C and 0.0% CO₂.
8. If you are not planning to humidify the incubator, leave the humidity tray in place and *skip to Step 4 in Section 3.3 below*.

3.3 Using the Humidity Tray

1. Fill the humidity tray with 2.5 liters of warm (~ 37.0°C) distilled water.
2. *For cell culture work*, we recommend the addition of one small teaspoonful (~0.11oz or 3.2g) of copper sulphate (or another recognized biocide) 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 should be cleaned with a solution of 70% isopropyl alcohol and 30% distilled water.

**CAUTION!**

Never leave water in the humidity tray if the incubator is switched OFF, as this may cause damage to the CO₂ sensor.

4. Let the incubator run until programmed conditions are achieved (preferably overnight), to allow conditions to stabilize within the incubator before use.

3.4 Setting Temperature & CO₂

At this time, program the desired Temperature and CO₂ setpoints. Temperature and CO₂ may be set within the following ranges (*see Table 4 on the following page*):

Table 4: Temperature & CO₂ Setpoint Ranges

Parameter	Available Setpoint Range
Temperature	10°C to 50°C (must be at least 1°C above ambient)
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 display.
3. Press the Enter (◀) key to save the setpoint. The CO₂ display will flash.
4. Now you can set the CO₂ level.

To set the CO₂ level:

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

If at any time you wish to change the CO₂ level without adjusting the Temperature setpoint, press the Programming (*) key to work in the CO₂ display, then press the Enter (◀) key.

NOTE:

Allow the incubator to stabilize at the setpoints selected before continuing.

3.5 Programming the Alarm System

3.5.1 Setting High & Low Temperature Alarms

1. Press the ◀ & ▼ keys simultaneously to enter Alarm Program Mode. The display will show **°C. AL**.
2. Press the ◀ key to display the High Temperature Alarm, **HI 37.5**. The factory setting is the setpoint value (37.0°C) + 0.5°C.
3. If you wish to adjust the High Temperature Alarm, use the ▲ or ▼ key. The minimum setting, however, is 0.5°C from setpoint.
4. Press the ◀ key to save the setting, whether or not you have changed it. Now 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 ▲ or ▼ key if you wish to adjust the value.
6. Press the ◀ key to accept the setting, whether or not you have changed it.

7. Press the Programming (*) key twice to exit the menu.

3.5.2 Setting the CO₂ High & Low Alarms

1. Enter the Alarm Program Mode (*see Step 1 of Section 3.5.1 above*), then press the ▲ key. The display will show CO₂ **AL**.
2. Press the ◀ key to display **HI.5.5**. The factory setting is the setpoint value (5.0%) + 0.5%.
3. If you wish to adjust the High CO₂ Alarm, use the ▲ or ▼ key. The minimum setting, however, is 0.5°C from setpoint.
4. Press the ◀ key to save the setting, whether or not you have changed it. Now the Low CO₂ Alarm is displayed, **LO 4.5**. The factory setting is the setpoint value (5.0%) - 0.5%.
5. Use the ▲ or ▼ key if you wish to adjust the value.
6. Press the ◀ key to accept the setting, whether or not you have changed it.
7. Press the Programming (*) key twice to exit the menu.

3.5.3 Door Open Alarm

When you open the door, an alarm will sound after a preset time delay. If you wish to adjust the time delay:

1. In Alarm Program Mode (*see Step 1 of Section 3.5.1 above*), press the ▲ key, the display will show **door AL** (reading across both displays).
2. Press the ◀ key and the ▲ & ▼ 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 ◀ to save the desired value.
4. Press the Programming (*) key twice to exit the menu.

3.5.4 Alarm Duration

The following steps will adjust the length of time during which **all audible alarms** will last:

1. In Alarm Program Mode (*see step 1 of Section 3.5.1 above*), press the ▲ key. The display shows **Per. Iod** (reading across both displays).
2. Press the ◀ key and the ▲ & ▼ 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 ◀ to select the desired value.
4. Press the Programming (*) key twice to exit the menu.

3.5.5 Alarm Arming Delay

This 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 prevent unnecessary alarms from occurring. To change the delay:

1. In Alarm Program Mode (*see step 1 of Section 3.5.1 above*), press the ▲ key. The display will show *dr . dEL* (across both windows).
2. Press the ◀ key and the ▲ & ▼ 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 ◀ to select the desired value.

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

NOTE:

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

3.6 Chamber Alarm System

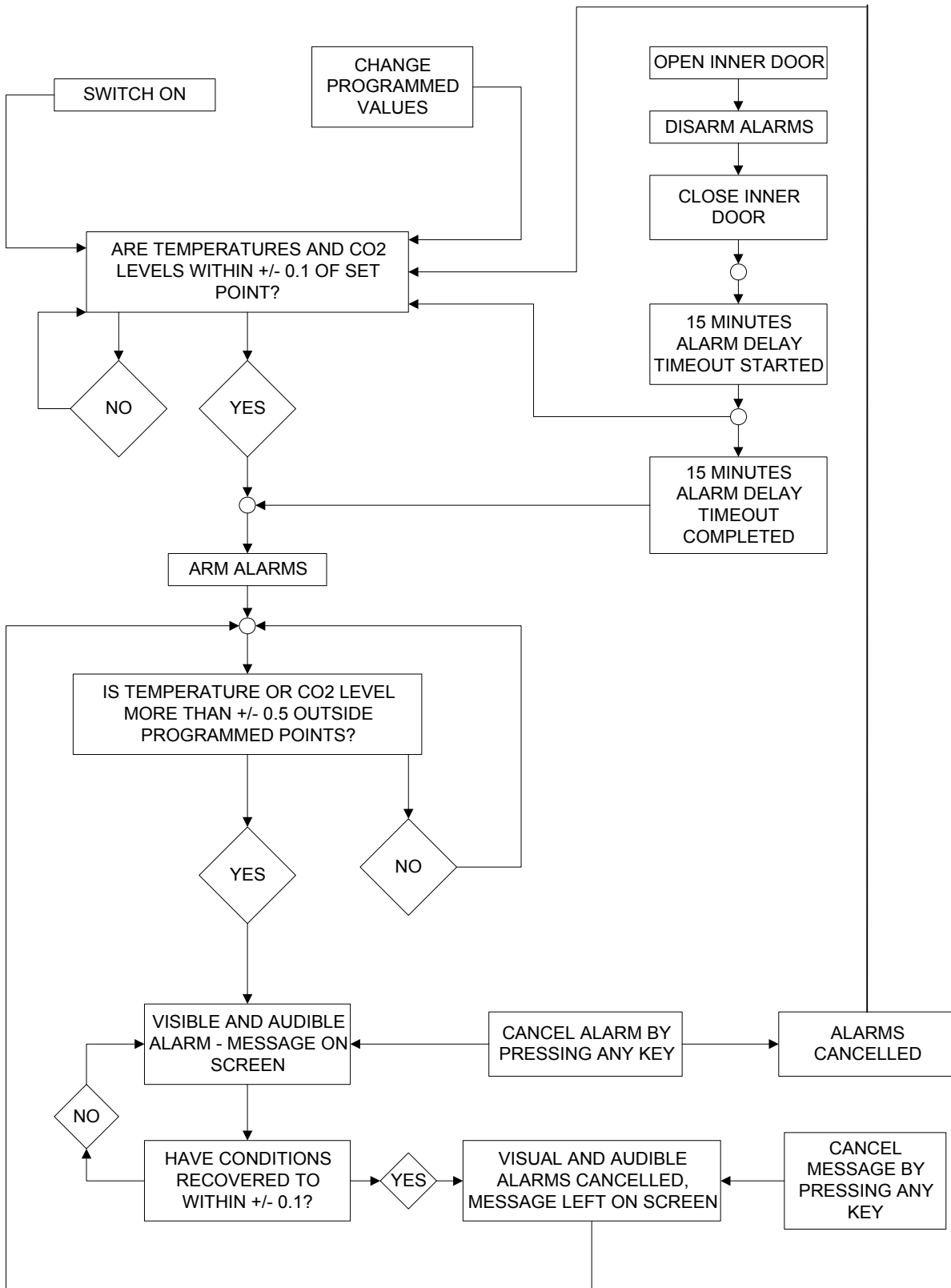
When the incubator is switched **ON**, or after any values have been reprogrammed, the Alarm System is inactive until the setpoint values (± 0.1) are achieved, after which the Alarm System is armed. *See Figure 10, Chamber Alarm System Flow Chart, on the following page.*

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 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 rearmed; 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 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 Section 3.5.4 above*).

Figure 10: Chamber Alarm System Flow Chart



3.6.1 Temperature Sensor System Alarms

There are four temperature sensors: two in the door and two in the chamber. 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.

3.6.2 Over-Temperature Cut-out & 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 **°Ct riP** . 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 cut-out 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.

4 ROUTINE MAINTENANCE

4.1 General Notes

To ensure that chamber conditions remain as stable as possible, be sure to 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 its 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 in *Section 3.3*.

4.2 Daily Checks

1. Check that the temperature and CO₂ levels are reading within specification.
2. Check the reserve pressure in the CO₂ cylinder (normally 725psi or 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. If there is a significant drop at the cylinder pressure of 725psi or 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.

4.3 Weekly Checks

Refill the humidity tray (to a maximum volume of 2.5 liters). The use of warm water (~ 37.0°C) will ensure a rapid return to optimum chamber conditions.

4.4 Monthly Checks

1. 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. The CO₂ sample port is located on the righthand side of the equipment tray (*see Figure 7*).

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.
- Remember to re-set the CO₂ setpoint to the desired level after sampling.

5 SERVICE

5.1 Fuse Replacement

To replace a fuse, you will need an ordinary flat-bladed (5mm or 1/5 inch maximum) screwdriver.

1. Using the flat-bladed screwdriver, rotate the fuse holder (*see Figure 7 for location*) counterclockwise until the fuse holder springs out.
2. Remove the spent fuse.
3. Install a new 10-amp fuse of the same type.
4. Orient the fuse holder back in the side panel and, using the screwdriver as before, secure it in place.

6 CLEANING & DISINFECTING

6.1 *Cleaning*

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

6.2 *Disinfecting*

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



WARNING!

- ◆ 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% CO₂ and switch off the incubator. Unplug the unit from the power supply.
2. Dampen a clean cloth with the alcohol solution and wipe down all external surfaces, taking care to keep the alcohol solution from coming into contact with any 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.



CAUTION!

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

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

**CAUTION!**

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

7. Wipe the internal components of the chamber twice with the alcohol/water solution. Wipe off excess liquid and leave it to dry completely.
8. Re-assemble the shelf racks, the humidity tray and the shelves, 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. Refill the humidity tray (*as explained in Section 3.3*).
11. Leave the incubator on for at least two hours (preferably overnight) to allow conditions to stabilize.

7 SPECIFICATIONS

Model ECO-170 Incubator Specifications	
Temperature Management	<ul style="list-style-type: none"> ▪ Digital programming via microprocessor control on 0.1°C increments. Measurement of chamber, outer door & both heating element temperatures via 4 RT¹ matched thermistors (sensitivity 0.01°C) ▪ “Out of Limits” temperature protection system independent of microprocessor control.
Range	1°C above ambient temperature ² to 50°C.
Control	± 0.2°C
Stability	± 0.3°C
Uniformity	± 0.2°C
Ambient Operating Conditions	10-35°C (maximum) 20-80% relative humidity, non-condensing
CO₂ 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%
Recovery Rate	Within 0.5% of setpoint
Gas Connections	6mm or ~1/4-inch tubing
Required Gas Pressure	0.35 bar / 5 psi
Relative Humidity	Removable stainless steel humidity tray.
Reservoir Capacity	2.5 liters
Humidity Control	95% at 37°C
Shelves	Polished stainless steel, non-perforated (standard).
Capacity	2000cm ² per shelf
Number of Shelves	4 standard; with multiple position option, up to 8 shelves
Alarm Systems	Two-level alarm system giving programmable audio/visual warnings with options for remote communication. Level 1 signals system failures, level 2 is programmable and monitors chamber conditions.
Dimensions	
Chamber (HxWxD)	693 x 540 x 444mm (27.3 x 21.3 x 17.5 inches)
Chamber Volume	170 liters (6 cu ft)
External (HxWxD)	845 x 685 x 670mm (33.3 x 27 x 26.4 inches)
External, Crated (HxWxD)	1050 x 820 x 760mm (41.3 x 32.3 x 29.9 inches), pallet included
Weight	Crated: 112 kg (246 lbs) Uncrated: 75 kg (165 lbs), with standard features

...continued...

¹ RT = Resistance Temperature curve

² 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. Contact your NBS representative for details.

Model ECO-170 Incubator Specifications	
Grounded Electrical Supply	
Voltage:	110-120V 50/60Hz or 220-240V 50/60Hz
Power:	500 watts or 1000 watts with high-temperature decontamination option
Energy to maintain 37°C:	< 0.1kwh
Storage Temperature	10 - 50°C

 **NOTE:**

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

Software calibration adjustments may be required to 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 NBS. Please be prepared with the model and serial number of your incubator and the complete details of your operating conditions.

8 OPTIONS

Most options must be factory-installed, while some may be retrofitted on-site by authorized service personnel. Some combinations of options may not be possible, and some options may incur extra cost: please inquire before ordering.

Option	NBS Part Number	Retrofittable
Access Port, 25mm	P0628-5501	No
BMS Relay Contact Alarm	P0628-5651	Yes
Copper Chamber	P0628-5611	No
Four Inner Doors	P0628-6410	Yes
Glass Inner Door (one)	P0628-6400	Yes
Below Bench Castor Set (two castors)	P0628-6160	Yes

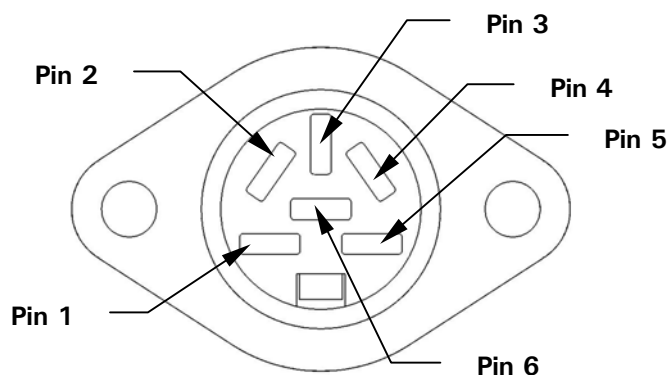
8.1 BMS Relay Contact Alarm

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 alarms would activate the system: over-temperature, under-temperature, system failure, CO₂ high and CO₂ low. The alarm is programmed to indicate when there is a power failure or electrical fault (power surge or short circuit, for example). The alarm may also respond to other alarm situations, according to other options installed on the system.

The system connection is via a standard 6-pin DIN socket on the rear panel of the incubator (see *Figure 9* for location & *Figure 11* for detailed look). The matching plug is provided when the option is installed.

Figure 11: BMS Relay Contact Alarm Socket



See Table 5 on the following page for the designation of the six pins.

Table 5: BMS Relay Contact Alarm Socket Pin Designation

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

The default setting for the alarm system is OFF. To activate the relay using the incubator keypad:

1. Press the ◀ and ▼ keys simultaneously to enter the Alarm Program Mode.
2. Press the ▲ key until *rELAy* is shown in the display.
3. Press the ◀ key to select the option.
4. The default setting is *nO* (OFF); press the ▲ key to change the display to *yEs* (ON) or press the ▼ key to return the display to *nO* (OFF).
5. Press the ◀ key to accept the selection.
6. To return to the temperature and CO₂ display screen, press the * key twice.

8.2 High Temperature Decontamination

High Temperature Decontamination 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 the programmed temperature) when normal control takes over.

The incubator must be cleaned, decontaminated chemically, and dried thoroughly before starting the process. The inner and outer door seals must be cleaned carefully and all surfaces wiped over with decontaminant (see the instructions in Section 6, *Cleaning & Disinfecting*).

NOTE:

- **Overly vigorous cleaning may damage the seals.**
- **The shelves and humidity tray should also be in place during the cycle.**
- **The black PVC protective CO₂ sensor cover must be removed before starting a cycle.**
- **The white porous CO₂ sensor cover can remain in place, although it may suffer damage over time during the high temperature decontamination cycle. Replacement covers are available; see Section 9.1 for information.**

**CAUTION!**

The chamber walls and CO₂ sensor all achieve temperatures of 120°C, particularly in areas that are inaccessible to chemical decontamination. Certain areas of the glass door and inner door seal surface temperatures will be somewhat lower (at 115°C ± 5°C). This is the minimum temperature necessary to eliminate *Bacillus Subtilis*, which is the standard organism specified by the US Pharmacopeia to validate sterilization of chamber interiors.

It is important that these areas be chemically decontaminated prior to running a High Temperature Decontamination cycle to ensure effective decontamination.

**WARNING!**

The incubator **MUST** be clean and dry before you continue. If it is not, major and permanent damage may occur.

**WARNING!**

DO NOT open the door during the decontamination cycle because of the dangerously high temperatures involved. Serious burns could occur if the door is opened during the cycle.

To begin the decontamination process:

1. Simultaneously cycle press the ▼ and * keys, then release them.
2. The display will change and the following prompt will appear: *HOT. de.CON
CYCLE Ent. Er StA.rtS* .
3. Press the ◀ Key to begin the cycle (or press the * Key to cancel the operation). The ◀ Key command will only be accepted when the entire message has been displayed at least once.
4. When the decontamination cycle starts, the display will show another prompt: *Is
InS.IdE CLE.An And.drY* .
5. Press the ◀ Key again (or press the * Key to cancel the operation). The ◀ Key command will only be accepted when the entire message has been displayed at least once.

During the three stages of the decontamination cycle, the display keeps the user informed by scrolling through a sequence of messages as shown on the following page:

- Current chamber temperature (in °C) and time remaining (hours & minutes) are indicated as **120. 2. 45** (i.e., 120°C with 2 hours and 45 minutes remaining).
- Every 10 seconds, by flashing one of the following messages for one second, the display will indicate which decontamination stage the incubator is in:
 - **HE.At** (heating to 120°C)
 - **dEC.On** (maintaining 120°C)
 or
 - **Co.oL** (cool down).
- The time displayed counts up during the heat and cool stages, but it counts down from 4 hours during the decontamination stage. After the cooldown phase is completed, the following messages will be displayed depending on the outcome:
 - **dEC.ON PAS.SEd**
 or
 - **dEC.ON FAILED**
- If the message says that decontamination failed, it will be followed by any combination of the following messages:
 - **FAL.L dUr.Ing HEA.t** (this indicates that the temperature dropped more than 2°C over a 60-second period during the heating phase)
 - **FAL.L dUr.Ing dEC.On** (this indicates that the temperature fell below 118.0°C during the decontamination phase)
 - **rIS.E dUr.Ing COO.L** (this indicates that the temperature rose more than 2°C over a 60-second period during the cooldown phase)
 or
 - **Can.CEL BUt.tOn PrE.SS** (this indicates that the CANCEL button was pressed during the heating or decontamination phase)

If more than one of the above-mentioned events occurred, the messages will be displayed consecutively in the sequence in which the events occurred.

The decontamination cycle can be cancelled at any time by pressing the * Key.

If the chamber temperature rises above setpoint or the element temperature is greater than the total of chamber setpoint + chamber low control point temperature, the system will automatically begin cooldown until these conditions are satisfied.

If the incubator door is opened—a *procedure that is highly discouraged because of the dangerously high temperature inside the chamber*—during a decontamination cycle, the process will continue as normal. A failure message will, however, appear if the temperature falls as a result of the door opening during either the heating phase or the decontamination phase.

If the incubator power is cycled OFF then ON, the incubator will power up as normal.

This condition will be indicated by an absence of a completed decontamination status message (either *dEC.ON PAS.SEd* or *dEC.ON FAI.Led*)

If the chamber temperature is above 65°C, the display will read **65.0** until the temperature drops below 65, and a **•CF.AIL** alarm will occur since the control system cannot measure temperatures above 65°C in normal mode.

8.3 Other Options

An RS-232 port (*see Figure 9 for location*) is available for factory installation or to be retrofitted on-site by an authorized service person.

A printer port (*see Figure 9 for location*) is available for factory installation only.

Two 50mm castors can be fitted to the unit in place of the rear feet. Each castor is attached directly to the base of the incubator with four M6 screws. Installation instructions accompany the castors when they are purchased.

9 ACCESSORIES

9.1 Available Accessories

Accessory	NBS Part Number
CO ₂ Bottle Automatic Change-Over Unit	P0628-5000
CO ₂ Two Stage Regulator	P0628-5010
CO ₂ Supply Line Filters, HEPA	P0628-5020
In-Line Pressure Regulator	P0628-5030
CO ₂ Gas Analyzer Kit	P0628-5040
10 Spare CO ₂ Gas Analyzer Tubes	P0628-5050
Stacking Stand For 2 Units	P0628-6270
Below Bench Castor Set	P0628-6160
Extra Shelf, Non-perforated	P0628-6241
Extra Shelf, Perforated	P0628-6251
Multi-Position Wire Shelf Racks	P0628-6390
Black PVC Protective CO ₂ Sensor Cover (5 per package)	P0628-5710
White Porous CO ₂ Sensor Cover (5 per package)	P0628-5900
10-Amp, 250V Replacement Fuse	P0380-3791

10 DRAWINGS & TABLES

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10.2 List of Tables

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