AIR-JACKETED CO_2 INCUBATOR 110 - 120 Voltage

SHEL LAB®

Installation and Operation Manual

SCO10A SCO5A

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SCO5A SCO10A AIR-JACKETED CO_2 INCUBATORS

Installation and Operation Manual

Part Number (Manual): 4861730

Revision: March 22, 2016

Note: The SCO10A consists of two stacked and bolted together SCO5A incubators. These incubators operate independently of one another.

These units are TÜV CUE listed as air-jacketed CO_2 Incubators for professional, industrial, or educational use where the preparation or testing of materials is done at an ambient air pressure range of 22.14 – 31.3 inHg (75 – 106 kPa) and no flammable, volatile, or combustible materials are being heated.

The units were tested to the following standards:

CAN/CSA C22.2 No. 61010-1:2012
CAN/CSA C22.2 No. 61010-2-010:2004 Reaffirmed: 2014-07
UL 61010-1:2012-05
UL 61010A-2-010:2002-03
EN 61010-1:2010
EN 61010-2-010:2014
Supplemented by: UL 61010-2-010:2015

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INTRODUCTION

Thank you for purchasing a Shel Lab product. We know that in today's competitive marketplace customers have many choices when it comes to constant temperature equipment. We appreciate you choosing ours. Our continued reputation as a leading laboratory product manufacturer rests with you. We stand behind our products and will be here for you if you need us.

These incubators are intended for laboratory, industrial, and educational microbiological cultivation applications. These incubators are not intended for use in hazardous or household locations.

Before you use the unit read this manual in its entirety to understand how to install, operate, and maintain the incubator in a safe manner. Keep this manual available for use by all operators. Ensure that all operators are given appropriate training before the incubator begins service.

GENERAL SAFETY CONSIDERATIONS

Note: Failure to follow the guidelines and instructions in this manual may create a protection impairment by disabling or interfering with the unit safety features. This can result in injury or death.

Your unit and its recommended accessories are designed and tested to meet strict safety requirements. It is designed to connect to a power source using the specific power cord type shipped with the unit.

For continued safe operation of your incubator, always follow basic safety precautions including:

- Always plug the incubator power cord into a protective earth grounded electrical receptacle (outlet) that conforms to national and local electrical codes. If the incubator is not grounded properly, parts such as knobs and controls can conduct electricity and cause serious injury.
- Do not bend the power cord excessively, step on it, or place heavy objects on it.
- A damaged cord can be a shock or fire hazard. Never use a power cord if it is damaged or altered in any way.
- Always position the unit so that the user can quickly unplug it in the event of an emergency.
- Do not attempt to move the unit while in operation or before the unit has cooled.
- Do not stack the unit without a factory-approved stacking rack or adaptor.
- Use only approved accessories. Do not modify system components. Any alterations or modifications to your incubator can be dangerous and void your warranty.
- Follow all local ordinances in your area regarding the use of this incubator. If you have any questions about local requirements, please contact the appropriate agencies.

ENGINEERING IMPROVEMENTS

Sheldon Manufacturing continually improves all of its products. As a result, engineering changes and improvements are made from time to time. Therefore, some changes, modifications, and improvements may not be covered in this manual. If your unit operating characteristics or appearance differs from those described in this manual, please contact your Shel Lab dealer or distributor for assistance.

CONTACTING ASSISTANCE

If you are unable to resolve a technical issue with the incubator, please contact Sheldon Technical Support. Phone hours for Technical Support are 6am – 4:30pm Pacific Coast Time (west coast of the United States, UTC -8). Please have the following information ready when calling or emailing: the **model number** and the **serial number** (see page 11).

EMAIL: tech@shellab.com PHONE: 1-800-322-4897 extension 4, or (503) 640-3000 FAX: (503) 640-1366

Sheldon Manufacturing INC.
P.O. Box 627
Cornelius, OR 97113
USA

RECEIVING YOUR INCUBATOR

INSPECT THE SHIPMENT

- When a unit leaves the factory, **safe delivery becomes the responsibility of the carrier**.
- Damage sustained during transit is not covered by the manufacturing defect warranty.

When you receive your unit, inspect it for concealed loss or damage to its interior and exterior. If you find any damage to the unit**, follow the carrier's procedure for claiming damage or loss**.

1. Carefully inspect the shipping carton for damage.
2. Report any damage to the carrier service that delivered the unit.
3. If the carton is not damaged, open the carton and remove the contents.
4. The unit should come with an Installation and Operation Manual.
5. Verify that the correct number of accessories have been included.

Included Accessories SCO5A

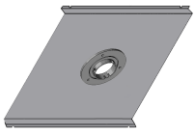
1 Copper Pan Token

5800529

1 Access Port Stopper*

7750514

1 Ceiling Air Duct



5121527

1 Chamber HEPA Filter

2800517

1 Chamber Filter Cap

6500606

1 CO_2 Tubing Kit

9710500

CO_2 HEPA Filter

2800525

1 Humidification Pan

995-00015

4 Leveling Feet

2700512

Power Cord

1800510

6 Shelf Slides

5121026

4 Stainless Steel Shelf Standards

5170646

3 Shelves

5121525

Included Accessories SCO10A

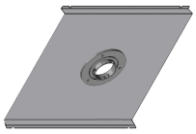
2 Copper Pan Tokens

5800529

2 Access Port Stoppers*

7750514

2 Ceiling Air Ducts



5121527

2 Chamber HEPA Filters

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2 CO_2 HEPA Filters

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2 Humidification Pans

995-00015

8 Leveling Feet

2700512

2 Power Cords

1800510

12 Shelf Slides

5121028

8 Stainless Steel Shelf Standards

5170646

6 Shelves

5121525

REGULATOR

The incubator must be connected to either a building CO_2 gas supply system or a supply cylinder (tank). A cylinder regulator is not included with the incubator, and must be purchased separately. Please see the **Accessories** section on page 55 if you wish to order one from Shel Lab.

Figure 1: CO_2 Regulator (9740558)

ORIENTATION PHOTOS

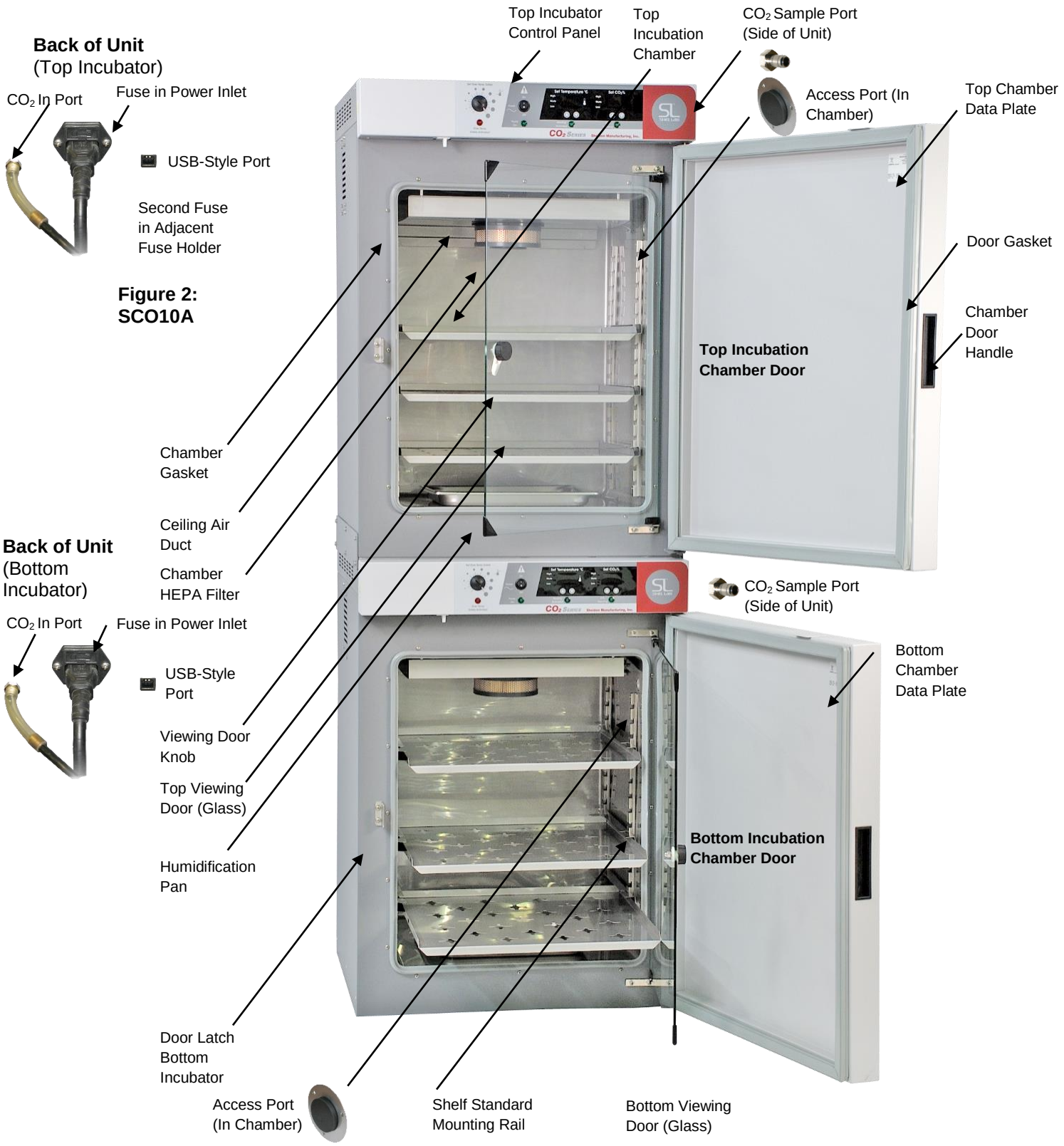
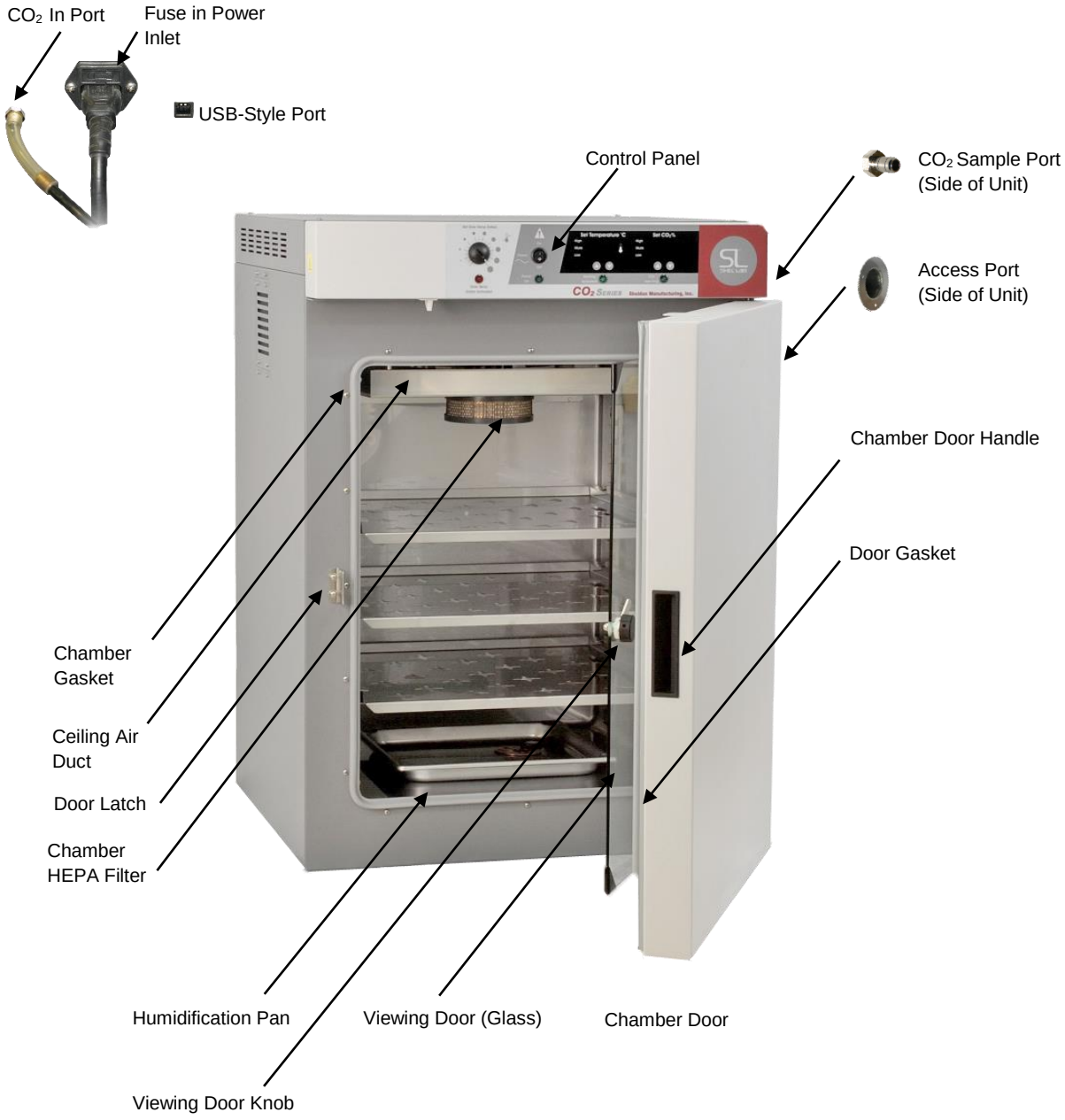


Figure 2: SCO10A

Back of Unit

Figure 3: SCO5A



RECORDING DATA PLATE INFORMATION

Locate the data plate on the back of the bottom incubator unit, adjacent to the power cord inlet. The data plate contains the incubator model and serial numbers. Enter this information below for future reference.

The SCO10A is also provided with individual SCO5A incubator unit data plates on the top right corner of each incubation chamber door interior. You **do not** need to record the SCO5A door data plate information here.

Date Plate Information

Model Number	
Serial Number	

REFERENCE SENSOR DEVICES

Reference sensor devices or a combined device must be purchased separately in order to perform accuracy verifications and calibrations of the incubator temperature and CO_2 displays.

Reference devices must be accurate to at least 0.1°C and 0.1% CO_2. The devices should be regularly calibrated, preferably by a third party. For best temperature results, use a digital device with a wired-connected temperature sensing probe that can be placed in the incubation chamber through the unit access port. For example a wire thermocouple probe. For best CO_2 accuracy, use a calibrated digital gas analyzer with sample tubing that can be connected to the incubator external CO_2 sample port.

Reference readings that avoid chamber door openings during verification and calibration eliminate subsequent waits for the chamber temperature and gas levels to re-stabilize before proceeding. This also allows temperature and gas verifications or calibrations to be performed simultaneously.

Select probes suitable for the application temperature you will be calibrating or verifying the incubator displays at.

Alcohol thermometers are insufficient for conducting accurate temperature verifications and calibrations. Do not use a mercury thermometer. **Never place a mercury thermometer in the incubation chamber.**

INSTALLATION CHECKLIST

Carry out the steps and procedures listed below to install the unit in a new workspace location and prepare it for use. All procedures are found in the Installation section of this manual.

Pre-Installation

- ✓ Procure a CO_2 gas supply for the incubator with a concentration suitable for your application. Always use medical grade CO_2.
- ✓ Check that the required ambient conditions, ventilation, and spacing for the incubator are met, page 14.
    - Unit dimensions may be found on page 52
- ✓ Check for performance-disrupting heat and cold sources in the environment, page 14
- ✓ Check that a suitable electrical outlet and power supply is present, page 14

Install the Incubator in a suitable location

- ✓ Review the lifting and handling instructions, page 15
- ✓ Install the incubator in its workspace location, page 15
- ✓ Make sure the incubator is level, page 15

Set up the Incubator for use

- ✓ Clean and disinfect the incubator and accessories that will be placed in the incubation chamber, page 16
    - Do not use deionized water to clean the unit, see page 15
- ✓ Install the shelving in the incubation chamber, page 17
- ✓ Connect the incubator to the CO_2 gas supply source, page 18
- ✓ Verify the port stopper is installed in the access port inside the incubation chamber, page 19

REQUIRED AMBIENT CONDITIONS

SCO incubators are intended for use indoors at room temperatures between **15°C and 30°C (59°F and 86°F)**, at no greater than an ambient **80% Relative Humidity** (at 25°C / 77°F).

- **4 inches (10cm)** minimum ventilation clearance between the incubator and walls or partitions.
- **2 inches (5cm)** minimum clearance above the top of the incubator for unobstructed airflow.

Operating the unit outside these conditions may adversely affect its temperature range and stability. For conditions outside of those listed above, please contact your distributor to explore other unit options suited to your laboratory or production environment.

ENVIRONMENTAL DISRUPTION SOURCES

When selecting a location to install the incubator, consider all environmental conditions that can affect the unit temperature performance. For example:

- Proximity to ovens, autoclaves, and any device that produces significant radiant heat
- Heating and cooling ducts, or other sources of fast-moving air currents
- High-traffic areas
- Direct sunlight

POWER SOURCE REQUIREMENTS

When selecting a location for the unit, verify that each of the following requirements are satisfied.

Wall power sources must match the power requirements listed on the unit data plate. These units are intended for 110 – 120 VAC 50/60 Hz applications at **6.0 amps**.

- Wall power sources must be protective earth grounded and conform to all national and local electrical codes.
- **Supplied voltage must not vary more than 10% from the data plate rating**. Damage to the unit may result if supplied voltage varies more than 10%.
- Use a separate circuit to prevent loss of product due to overloading or circuit failure. The circuit must match or exceed the amperage requirement listed on the unit the data plate.

The unit must be positioned so that all end-users can quickly unplug power cords in the event of an emergency.

- The unit is provided with a 115 volt 15 Amp, 9ft 5 in (2.86m) NEMA 5-15P power cord for each inlet (SCO5A 1 cord, SCO10A 2 cords).
- The unit is provided with a 250V time-lag T 10 amp 5x20mm fuse located in **each** power inlet.

LIFTING AND HANDLING

The unit is heavy. Use appropriate powered lifting devices. Follow these guidelines when lifting and handling the unit:

- Lift the unit only from its bottom surface.
- Doors, handles, and knobs are not adequate for lifting or stabilization.
- Restrain the unit completely while lifting or transporting so it cannot tip.
- Remove all removable components, such as shelving, and secure all doors in the closed position during transfer to prevent shifting and damage.

INSTALL INCUBATOR IN LOCATION

Install the unit in a workspace location that meets the criteria discussed in the previous entries of the Installation section.

LEVELING

Install the leveling feet shipped with the unit. The unit must be level and stable for safe operation.

Figure 4: Leveling Foot

1. Insert one leveling foot into each of the four holes in the bottom corners of the unit.
2. Adjust the foot at each corner until the unit stands level and solid without rocking. To raise a foot, turn it in a counterclockwise direction.
3. To lower a foot, turn it in a clockwise direction.

Note: To prevent damage when moving the unit, turn each of the four leveling feet completely clockwise.

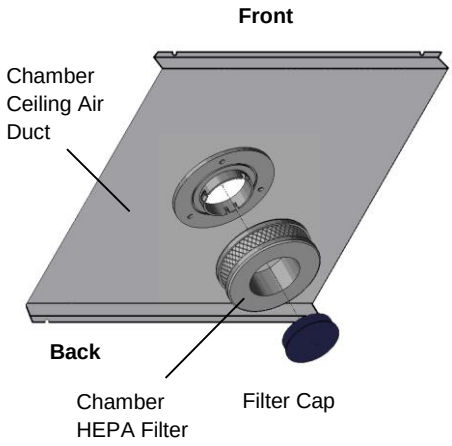
DEIONIZED AND DISTILLED WATER

Do not use deionized water to clean or humidify the incubator, or fill the water jacket. Use of deionized water may corrode metal surfaces and voids the warranty. The manufacturer recommends the use of distilled water in the resistance range of 50K Ohm/cm to 1M Ohm/cm, or a conductivity range of 20.0 uS/cm to 1.0 uS/cm, for cleaning, humidifying, and water-jacketing applications.

INSTALLATION - CLEAN AND DISINFECT

Cleaning and disinfecting the unit incubation chamber, shelving components, and ceiling air duct now reduces the risk of contamination. The chamber and shelving were cleaned and disinfected at the factory, however, the unit may have been exposed to contaminants during shipping.

- Remove all protective wrappings from shelving components and the ceiling air duct prior to cleaning.
- **Do not clean the chamber HEPA filter!**
- See the **Cleaning and Disinfecting** entry on page 40 for information on how to clean and disinfect without damaging the incubator or its components.



INSTALL CHAMBER HEPA FILTER AND DUCT

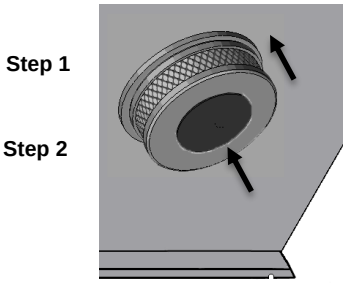
Note: Exercise caution to avoid striking the sensors and blower fan wheel on the chamber ceiling when installing the duct.

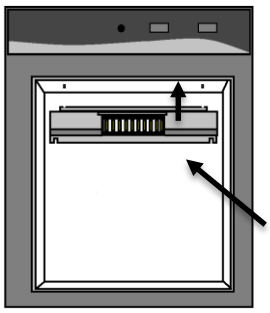
Note: The incubator must be turned off and unplugged when carrying out this procedure.

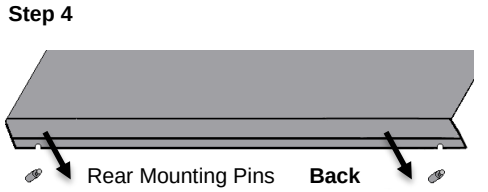
The ring-style chamber HEPA filter traps particulates, as well as isolating and killing airborne microbes in the incubation chamber.

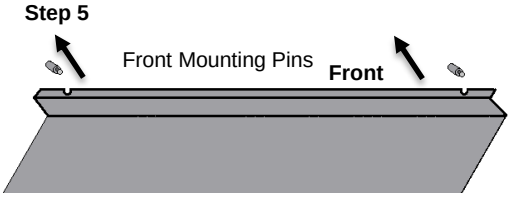
Perform the following steps to install the filter and ceiling air duct.

1. Snap the chamber HEPA filter to the mounting collar on the chamber ceiling air duct.
   a. It may be necessary to tilt the filter to one side or the other.
2. Snap the filter cap to the HEPA filter.
3. Move the air duct into the incubation chamber with the attached HEPA filter facing down.
4. Mount the back of the air duct on the rear chamber mounting pins, one pin at a time.
5. Mount the front of the duct on the front chamber mountings, one at a time.









SHELVING INSTALLATION

Note: Always install the copper token in the humidification pan. Copper is known to have antimicrobial properties that retard the growth of microorganisms in the pan.

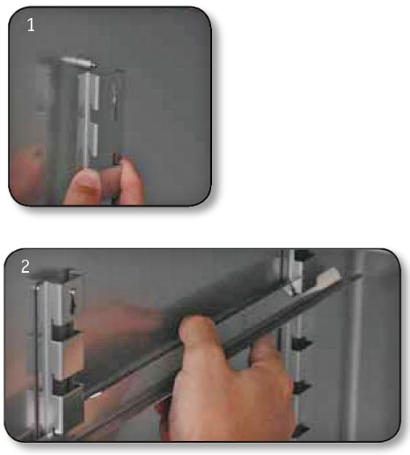


Figure 5: Shelving Installation

Install the shelving and humidification pan in the in the incubation chamber.

1. Install the shelf standard rails.
    a. Align the keyhole slot of the standard with the mounting peg on the side of the chamber wall.
    b. Mount the shelf standard.
2. Install the shelf slides.
    a. Insert the shelf slide into the shelf standard using a rocking motion.
    b. The shelf slide will sit level when correctly installed.
3. Install the shelves.
    a. Slide into position.
4. Install the humidification pan.
    a. Place the copper token in the humidity pan.
    b. Secure the token using the clip on the bottom of the pan.
    c. Place the pan on the chamber floor.

CONNECT TO THE CO_2 SUPPLY

Note: Always use medical grade CO_2. Use of non-medical grade CO_2 risks introducing contaminants into the chamber may damage the incubator, and will void the manufacturing defect warranty.

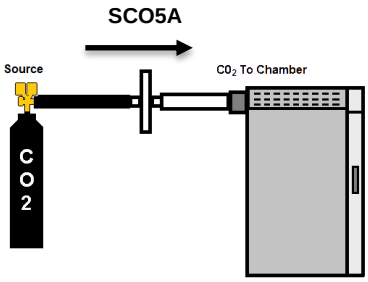
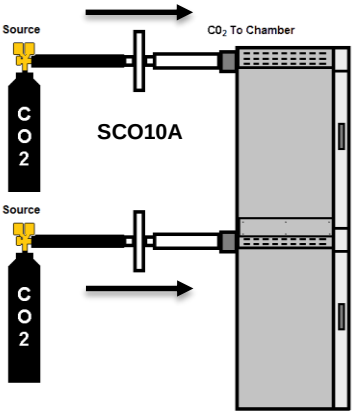


Figure 6: CO_2 Supply Source Connections



Each incubator may be connected to either a building supply source or a supply cylinder.

Two-Stage Regulators: If connecting to a supply cylinder **always use a two-stage CO_2 pressure regulator**. Be aware that some single-stage regulators have 2 gauges. Make certain your regulator is a two-stage regulator. Precise regulation of the gas input flow is vital for the incubator performance.

Connect to the CO_2 supply (perform once for incubator in the SCO10A stack)

1. Attach the CO_2 regulator to a medical grade CO_2 cylinder, if using a cylinder supply.
2. Set the wall source control or cylinder regulator to 15 - 20 Pounds per Square Inch (psi). **Do not exceed 25 psi.**

PSI	Megapascals	Kilopascals	Bar
15 - 20 psi	0.103 - 0.137 Mpa	103.42 - 137.89 Kpa	1.03 - 1.378 bar

Figure 7: Gas Tubing Kit

Figure 8: CO_2 to Chamber

3. Remove the dust cover from the CO_2–to-Chamber port on the back of the unit.
4. Connect the gas tubing to the incubator and regulator or wall source.
   a. Connect the **black tubing** to the regulator or wall source.
   b. Connect the **clear tubing** to the CO_2 to Chamber port on the back of the incubator.
5. **Do not start a flow of CO_2** to the incubator at this time.

End of procedure

ACCESS PORT STOPPER

Verify that a port stopper is installed in the access port on the right side of each incubator. The unit will not meet its temperature performance specifications or maintain a CO_2 set point without a stopper installed.

Stoppers should always be installed inside the chamber to obtain the best temperature uniformity and prevent condensation from forming inside the port.

Figure 10: Port Stopper

Figure 9: Port Stopper in Access Port

GRAPHIC SYMBOLS

Each incubator is provided with multiple graphic symbols on its exterior and internal surfaces. These symbols identify hazards, and the functions of the adjustable components, as well as important notes in the user manual.

Symbol	Definition
	Indicates that you should consult your service manual for further instructions. Indique que l'opérateur doit consulter le manuel d'utilisation pour y trouver les instructions complémentaires.
	Indicates Temperature Repère température
	Indicates the Over Temperature Limit system Indique le système de dépassement de temperature
	Indicates AC Power Repère le courant alternatif
	Indicates I/ON and O/OFF I repère de la position MARCHE de l'interrupteur d'alimentation O repère de la position ARRÊT de l'interrupteur d'alimentation
	Indicates protective earth ground Repère terre électrique
	Indicates UP and DOWN respectively Touches de déplacements respectifs vers le HAUT et le BA

GRAPHIC SYMBOLS (CONTINUED)

Symbol	Definition
	Indicates Potential Shock Hazard Signale danger électrique
	Indicates the unit should be recycled (Not disposed of in land-fill) Indique l'appareil doit être recyclé (Ne pas jeter dans une décharge)
	Indicates CO_2 Gas Indique gaz CO2

CONTROL PANEL OVERVIEW

Figure 11: Control Panel

Over Temperature Limit Thermostat (OTL)

This graduated dial sets the heating cut off point for the OTL temperature limit system. The OTL system prevents unchecked heating of the chamber in the event of a failure of the main digital controller. For more details, please see the **Over Temperature Limit System** description in the Theory of Operations (page 25).

The red Over Temp Activated light illuminates when the Over Temperature Limit system cuts off heating by rerouting power away from the heating elements.

Power Switch

The power switch controls all power to each incubator and its systems. Power is supplied when the switch is in the (I) on position and the Power On light illuminated.

Temperature Control and Display

Labeled Set Temperature °C, this display shows the current air temperature in the incubation chamber accurate to within 0.1°C. The arrow buttons can be used to adjust the temperature set point, or place the display in its temperature calibration mode and then enter a display value correction.

Red LED alarm indicators marked High and Low illuminate whenever the temperature deviates by ±1°C or greater from the current set point. The yellow LED marked Mute illuminates whenever an audible deviation alarm is being muted. See the **Muting the Audible Temperature Alarm** entry on page 29 of the Operations section for more information.

The green indicator labeled Heating Activated illuminates whenever the temperature control system is heating the incubation chamber.

CO_2 Display

Labeled Set CO_2, this display shows the concentration of CO_2 in an incubation chamber as a percentage of the chamber atmosphere. The display has a range of OFF (0%) to 20% and an accuracy of 0.1%. The display shows “LO” until the CO_2 sensor registers a concentration in the chamber greater than 0%. When initially injecting CO_2 into the chamber a few minutes may be required to build up a sufficient concentration to register.

The **UP / DOWN** arrow pad can be used to adjust the CO_2 concentration set point and to mute audible gas deviation alarms. The control can also place the CO_2 display in its calibration mode, and be used to enter a calibration adjustment.

Red LED alarm indicators marked High and Low illuminate whenever CO_2 deviations of ±1% or greater from the set point take place. The yellow LED marked Mute illuminates whenever an audible deviation alarm is being muted. See the **Muting the Audible CO_2 Alarm** entry on page 31 of the Operations section for more information.

Marked CO_2 Injecting, this green indicator illuminates when the incubator is injecting CO_2 into the incubation chamber. Injections are accompanied by a clicking sound that is the CO_2 solenoid opening and closing.

THEORY OF OPERATION

The SCO5A and SCO10A are engineered to provide constant temperature CO_2 incubation environments that are passively humidified to prevent dehydration of sample media. Each unit can obtain a stable, uniform temperature in its chamber, ranging from the room temperature (ambient) +5°C up to 60°C for incubation applications. The CO_2 range is a 0 – 20% concentration.

Each incubator features a glass viewing door that allows visual inspection of samples without compromising the chamber CO_2 or humidity environment.

Each incubator unit in an SCO10A is independently powered, heated, humidified, and supplied with CO_2.

Heating

When powered, an incubator heats to and maintains the incubation chamber air temperature at the currently programmed temperature set point. An internal microprocessor stores the temperature set point. The microprocessor board is wired to a solid-state temperature probe located on the chamber interior right wall. When the processor detects that the chamber temperature has dropped below the temperature set point, it pulses power to heating elements located in the air-jacket insulation space and the outer chamber door. During normal operations with the doors closed most heating pulses correct for deviations of less than 0.1°C.

The processor employs proportional-integral-derivative analytical feedback-loop functions when measuring and controlling the chamber air temperature. PID-controlled heating pulse intensities and lengths are proportional to the difference between the measured chamber temperature and the current set point. The frequency of pulses is derived from the rate of change in that difference. The integral function slows the rate of pulses when the temperature nears the set point to avoid overshooting.

Each incubator relies on natural heat radiation for cooling. An incubator can achieve a low-end temperature of the ambient room temperature +5°C.

The chamber door is self-heating to bolster the thermal uniformity and stability of the chamber and to minimize condensation on the glass viewing door. The glass door will cool while the chamber door is opening, eventually leading to condensate on the door and impacting the chamber temperature stability and uniformity. Minimize sample viewing times when possible.

Insulation is provided by an insulation-filled air jacket.

CO_2 Atmosphere

The same microprocessor board controls the gas concentration of CO_2 in the chamber atmosphere by operating an internal injection solenoid valve connected to the gas input port. The processor monitors CO_2 concentration level in the incubator using an infrared sensor located behind the chamber ceiling duct. The sensor operates on the principle that a specific frequency set of infrared light is absorbed by CO_2. The more CO_2 present in the chamber, the more of that band of infrared is absorbed. The sensor is only sensitive to CO_2, so measurement accuracy is consistent, regardless of the presence of other gasses in the incubator.

The processor employs proportional-integral-derivative analytic feedback-loop functions when measuring and controlling the CO_2 concentration. When the PID are active, injection lengths are proportional to the difference between the measured concentration and the set point. The frequency of injections is derived from the rate of change in the difference. Integrator feedback slows the rate of injection as the concentration approaches the set point, which helps prevent overshoots. When the chamber concentration is stable CO_2 injections take place in small bursts to correct for deviations less than 0.1%. The incubator is not provided with a means to actively remove CO_2 from the chamber atmosphere.

Humidification

Passive humidification is provided by filling the humidification pan included with the unit. The pan is then placed on the heated chamber floor. Evaporation driven in part by heating raises the relative humidity percentage (RH%) of the chamber. A copper token included with the pan helps to significantly slow the growth of microbiological populations in the humidification water supply.

The incubator must be operated humidified in order to achieve its stated temperature specifications.

Physical and Data Access

An access port on the right side of the unit allows sensors, such as thermocouples and humidity meter solid state probes, to be inserted and left in the chamber without compromising the CO_2 atmosphere. An atmosphere sample port for independently verifying the CO_2 concentration in the chamber is provided on the right side of the unit, adjacent to the control panel. A USB-style serial port outputs CO_2 and temperature levels once per minute as a digital log line. Jack ports on the back of the unit provide the same outputs as analog 4 – 20 milliamp signals for use by a building monitoring system. Please see the **Data Output** entry on page 37 for more details.

The Over Temperature Limit System (OTL)

When set, the OTL system prevents runaway heating in the event of a main control failure by depowering the heating element whenever the temperature in the incubator chamber exceeds the OTL setting. The OTL is set **by the end-user**, typically at 1°C above the Set Temperature display set point. Because of its nature as a cutoff system and its lack of PID analytics, the OTL cannot deliver the same degree of temperature stability and measurement precision as the digital display and controls.

Note: From a cold start, the incubator requires 8 hours to come up to and stabilize at temperature and humidity levels prior to loading samples. Stabilization safeguards samples.

PUT THE INCUBATOR INTO OPERATION

Carry out the following steps and procedures to put the incubator into operation after installing it in a new workspace environment:

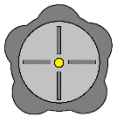
1. **Optional:** A clean and disinfected thermocouple probe for performing the optional temperature display accuracy verification may be inserted through the access port now.
    a. This saves time by allowing the incubation chamber temperature to stabilize undisturbed prior to the verification procedure.
    b. See the **Temperature Display Accuracy Verification procedure** on page 32 for the correct introduction and placement of the thermocouple probe.
2. Attach the power cord that came with the incubator to the power inlet receptacle on the back of the unit.
3. Plug the power cord into the workspace supply receptacle (outlet).

4. Place the **Power** switch in the on (I) position.
5. Perform the following procedures in the Operation section to finish preparing the incubator:

    Humidify the Incubator page 27

    Set the Temperature Set Point page 27

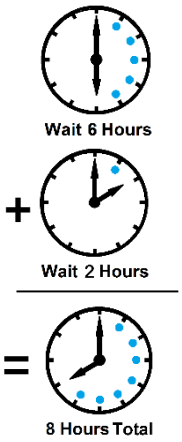
    Allow the incubator to heat undisturbed for 6 hours before continuing.



Open the CO_2 supply control or gas regulator so it supplies a flow of 15 - 20 psi, as per the supply description on page 30.

Set the CO_2 Set Point page 30

After setting the set point, wait for an additional 2 hours for a CO_2 concentration to establish and stabilize in the chamber, and for the unit to finish stabilizing thermally.



Optional: **Verify Temperature Display Accuracy** page 32

Optional: **Verify CO_2 Display Accuracy** page 34

Set the Over Temperature Limit page 36

Load the Chamber page 37

End of procedure

HUMIDIFY THE INCUBATOR

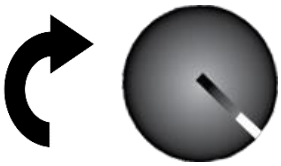
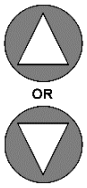
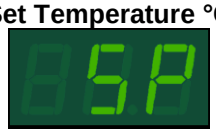
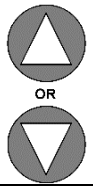
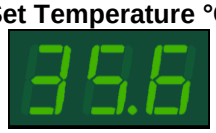
Fill the humidification pan in the incubation chamber. Make sure the pan has been placed on the chamber floor. The floor is heated and will help drive evaporation to raise the humidity level to 90 – 95% relative humidity. This helps slow the drying of samples in open, “breathable” containers.

- The humidification pan must be filled in order for the incubator to achieve its stated temperature uniformity specification.
- Always place and secure the copper token in the pan to slow the growth of microbiological populations in humidification water supply.
- Regularly clean and disinfect, or decontaminate the pan.
- Refill as needed, and change the water in the pan at least once per week.
- Use of chemical disinfectants added to the pan may alter the surface tension of the water. This may significantly reduce the rate of evaporation and impact the humidity level of the incubator chamber.
- **Never use deionized water** to humidify the incubator.

SET THE TEMPERATURE SET POINT

Perform the steps below to change the set point to the operational temperature you will be using during your incubation application. The incubator comes from the factory with a set point of 37°C.

Note: The visual example below depicts adjusting the incubator set point from 35°C to a 37°C application temperature.

Set Temperature Set Point	
1. Turn the **OTL** control clockwise to the maximum, if not already set to max. a. This prevents the Safety cutoff system from interfering with this procedure.	
 OR 2. Push and release either of the **temperature arrow buttons** to activate the temperature set point adjustment mode. a. The temperature display will briefly flash the letters “SP” to indicate the Set Point is about to be displayed. b. The temperature display will then show the flashing, adjustable temperature set point. **Note:** The display will automatically exit the adjustment mode after 5 seconds of inactivity, with the last shown set point value saved.	**Set Temperature °C**  **Initial Set Point**  **Set Point Adjustment Mode**
 OR 3. Use the **Up** and the **Down arrow keys** to adjust the set point to your application temperature.	**Set Temperature °C**  **New Set Point**
4. Wait 5 seconds after entering the set point.  Wait 5 Seconds a. The display will stop flashing, and the set point is now saved in the controller. b. The chamber will now automatically heat or passively cool to match your set point. c. The display will revert to showing the current chamber air temperature.	**Set Temperature °C**   **Heating to Set Point**
See the **Set the OTL procedure** on page 36 for how to set the OTL system once the incubation chamber has stabilized at your application temperature set point, after you have performed any display verifications or calibrations.	

End of Procedure

MUTING THE AUDIBLE TEMPERATURE ALARM

An audible and visual high or low deviation alarm will activate if the incubation chamber temperature deviates by 1°C above or below the temperature set point. The low deviation audible alarm has a delay of 15 minutes. This prevents the low alarm from sounding whenever the doors are opened, causing a short drop in temperature.

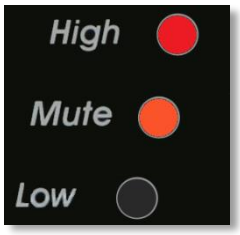
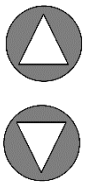


Figure 12: High Alarm Muted



1. To mute an active high or low deviation alarm, press and hold either the **Up** or **Down arrow** on the Temperature Control panel, until the amber Mute LED illuminates and the audible alarm shuts off.
    - The audible alarm component will remain muted for the duration of the **current** temperature deviation. The visual alarm indicator will remain illuminated.
    - Any new deviation of ±1°C or greater will reactivate the audible alarm.

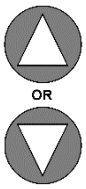
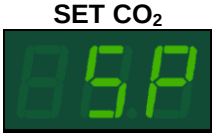
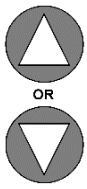
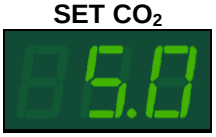
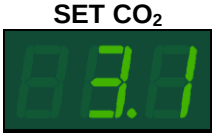
AUTOMATIC DOOR CUTOFF

Whenever an incubation chamber outer door is opened, the incubator stops the flow of CO_2 into the chamber, depowers the heater element, and ceases operation of the internal blower fan. This limits the amount of CO_2 released into the workspace around the incubator. It also prevents the heater from attempting to counteract the continual inflow of cooler air, which would cause a significant heat spike once the door is closed. Normal CO_2 injections, heating, and fan operation all resume automatically when the outer door is closed.

SET THE CO_2 SET POINT

Each incubator comes from the factory set to Off. Set the CO_2 set point to that of your application. The gas supply must continually deliver 15 - 20 psi while establishing and maintaining a CO_2-enriched chamber atmosphere. A CO_2 flow to the chamber must be started a minimum of 2 hours prior to the start of a display verification or calibration, or prior to loading samples in the chamber. The CO_2 display will read "LO" until enough CO_2 has built up for the sensor to register a concentration greater than 0%.

Note: The example below represents adjusting the CO_2 set point from Off to 5%.

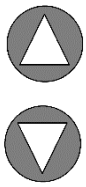
Set CO_2 Set Point	
 1. Push either the **Up** or **Down** arrow button on the CO_2 panel. a. The display will flash the letters "SP" for set point. b. A flashing, adjustable CO_2 set point will appear in the display. **Note**: The display will automatically exit the adjustment mode after 5 seconds of inactivity, with the last shown set point value saved.	**SET CO_2**   **Initial Set Point**
 2. Use the **Up** and the **Down arrow keys** to adjust the set point to your application CO_2 concentration.	**SET CO_2**  **New Set Point**
 3. Wait 5 seconds after entering the set point. a. The display will stop flashing, and the set point is now saved in the controller processor. b. The chamber will now automatically inject CO_2 or allow the current level to decay in order to achieve your set point. c. The display will revert to showing the current chamber concentration.	**SET CO_2**   **CO_2 Injecting to achieve the new set point.**
Note: The CO_2 display and injections can be set to off when in the set point adjustment mode. Hold the down arrow after the blinking set point appears until the display reads "OFF". The incubator will cease injecting CO_2.	

End of procedure

MUTING THE AUDIBLE CO_2 ALARM

Visual high or low deviation indicator alarms will illuminate if the chamber CO_2 level deviates 1% above or below the CO_2 set point. An audible alarm sounds immediately for a high deviation. The low deviation audible alarm will sound after the visual low indicator alarm has been continually illuminated for 15 minutes. This delay prevents the alarm from sounding whenever a door opening creates a short-lived drop in gas concentration.

1. To mute an alarm, press and hold the CO_2 **Up** or the **Down** arrow button until the amber Mute LED illuminates.



- The alarm will stay muted for the duration of the **current** temperature deviation.
- Another deviation of 1% will reactivate the audible alarm.

Figure 14: Low and No Gas Alarm Timeline

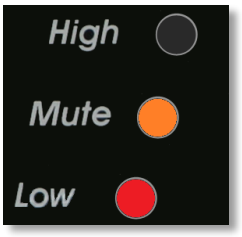


Figure 13: Low Gas Alarm Muted

NO GAS SUPPLY ALARM (NGS)

If the Low Gas deviation indicator is active for longer than 20 minutes, a second alarm will activate. The letters “ngS” will appear in the CO_2 display to indicate **No Gas Supply**. The alarm will remain active even if the incubator is turned off and turned back on. The NGS Alarm will remain on until CO_2 is restored to the chamber. It may take 2 or more minutes of CO_2 inflow to establish a concentration percentage (%) high enough to deactivate the alarm.

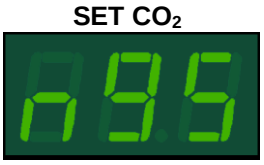


Figure 15: No Gas Supply

TEMPERATURE ACCURACY VERIFICATION

Note: Performing a temperature accuracy verification requires a temperature reference device. Please see the **Reference Sensor Devices entry** on page 12 for the device requirements.

Optional: This procedure verifies the accuracy of the incubator temperature display against the actual chamber air temperature as measured by a reference sensor device. Perform the procedure if required by your laboratory or production protocol. The unit was calibrated at the factory at 37ºC.

If a difference (also known as an error) between the actual and displayed temperatures is discovered, perform a temperature calibration. Please see the **Calibrate Temperature Display procedure** on page 44 in the User Maintenance section.

CO_2

A CO_2 display verification may be performed concurrently with the temperature verification. The unit must be supplied with CO_2 for at least 2 hours prior to the start of both procedures. During those hours and during the procedure the chamber door may not be opened.

Probes

Reference device sensing probes may be introduced through the access port. Carefully place the port stopper over any probe wires. Probes may also be introduced through the chamber door space. Use non-stick, non-marking tape to secure the wires and probe heads, and to seal any gaps. The door must close and latch fully.

Figure 16: Introducing a sensor probe through the access port.

Place the sensor probe of the temperature reference device as close as possible to the geometric center of the incubation chamber. A thermocouple sensor probe sleeve may be taped to the shelving, as long as the exposed copper end is 2 inches (5cm) away from the shelf (see Figure 17). An exposed sensor probe in direct contact with the shelving may experience heat sinking, which can result in an inaccurate temperature reading.

Stability

After introducing and placing the temperature probe, allow the incubator to run undisturbed for 8 hours (for example, overnight) prior to performing the verification.

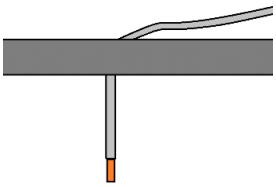


Figure 17: Probe End 2 inches (5cm) From Shelf Surface

Prior to a verification, the chamber must operate at its verification temperature set point for **at least 1 hour with no fluctuations** of ±0.1°C or greater in order to be considered stabilized. Failure to wait for stabilization will result in an inaccurate verification.

If the chamber door is opened during the temperature verification the chamber must be allowed to re-stabilize with no fluctuations before continuing.

Procedure continued on next page

Verifying the Temperature Display Accuracy	
1. Once the chamber temperature has stabilized, compare the reference temperature device and incubator display readings. a. If the readings are the same, or if a difference between the two (2) falls within the acceptable range of your protocol, the display is accurately showing the chamber air temperature. **The Temperature Verification procedure is now complete**. b. See step 2 if a difference falls outside the acceptable range of your protocol.	**Reference Device**  **Set Temperature °C** 
2. If there is an unacceptable difference, a display **temperature calibration** must be performed to match the display to the reference device. a. Please see page 44 in the User Maintenance section.	**Reference Device**  **Set Temperature °C** 

End of procedure

CO_2 ACCURACY VERIFICATION

Note: Performing a CO_2 display accuracy verification requires a gas reference device. Please see the **Reference Sensor Devices entry** on page 12 for the device requirements.

Optional: The CO_2 display was calibrated at the factory at a 5% concentration. A display accuracy verification may be performed when preparing the incubator for use if required by your laboratory or production protocol. The verification procedure compares the chamber CO_2 level as measured by the incubator with the actual level, as provided by a calibrated reference device.

If a difference between the actual and displayed CO_2 concentrations is discovered, perform a CO_2 display calibration. Please see the **Calibrate CO_2 Display procedure** on page 48 in the User Maintenance section.

Temperature

The incubation chamber should be heated to and stable at your application temperature, as temperature drives gas diffusion in the chamber. A CO_2 display verification may be performed simultaneously with the temperature display verification, **as long as the chamber door is not opened** during either procedure.

Probes

Connect a CO_2 reference device sample tube to the external sample port, located on the left side of the incubator, adjacent to the control panel.

Figure: 18 CO_2 Sample Port

Stability

Allow the unit to operate undisturbed to run for at least 8 hours for heat and humidity stability (for example, overnight) prior to performing the verifications. A CO_2 flow to the chamber may be started 2 hours prior to the start of the verification.

Prior to a verification, the chamber must operate at its CO_2 set point for **at least 1 hour with no fluctuations** of ±0.1% or greater in order to be considered stabilized. Failure to wait for stabilization will result in an inaccurate verification. If the chamber door is opened during the verification, the chamber must be allowed to re-stabilize before continuing.

Continued on next page

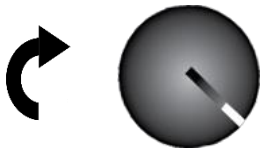
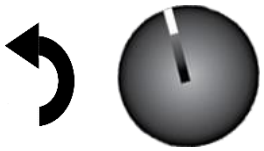
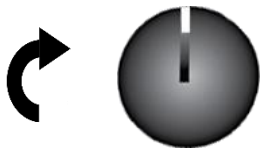
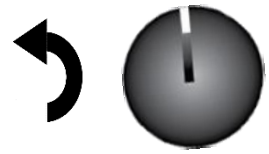
Verifying the CO_2 Display Accuracy	
1. Once the chamber has stabilized with no fluctuations, compare the gas reference device and chamber CO_2 display readings. a. If the readings are the same, or if a difference between the two (2) falls within the acceptable range of your protocol, the display is accurately showing the chamber CO_2 concentration. **The CO_2 Verification procedure is now complete**. b. See step 2 if a difference falls outside the acceptable range of your protocol.	**Reference Device**  **Set CO_2** 
2. If there is an unacceptable difference, a **CO_2 calibration** must be performed to match the display to the reference device. a. Please see page 48 in the User Maintenance section.	**Reference Device**  **Set CO_2** 

End of procedure

Note: Test the OTL system at least once per year for functionality.

SET THE OVER TEMPERATURE LIMIT

This procedure sets the Over Temperature Limit heating cutoff to approximately 1˚C above the current chamber temperature. Perform the steps below once the incubator has run with no temperature fluctuations at your application temperature set point **for at least 1 hour**.

Set OTL	Example
1. Turn the **Set Over Temperature Limit** control dial clockwise to the maximum position, if it is not already set to maximum.	
2. Turn the Over Temperature Limit control dial counterclockwise until the red Over Temperature Limit Activated light illuminates. 	
3. Slowly turn the dial clockwise until the Over Temperature Limit Activated light turns off. Stop turning the control.  a. The Over Temperature Limit is now set approximately 1˚C above the current chamber temperature.	
4. **Optional**: You may turn the dial slightly to the left to bracket in closer to the set point temperature. This sets the OT Limit nearer to the current chamber temperature. 	
5. Leave the OTL dial set just above the activation point.	

If the OTL activates sporadically, turn the dial very slightly to the right (clockwise) one time.

If the OTL continues activating, check for ambient sources of heat or cold that may be adversely impacting the unit temperature stability. Check if any powered accessories in the chamber are generating heat. If you can find no sources of external or internal temperature fluctuations, contact Tech Support or your distributor for assistance.

End of Procedure

LOAD THE INCUBATOR

Place items on the shelves inside the incubation chamber as evenly spaced as possible. Proper spacing allows for maximum air circulation and a high degree of temperature uniformity. Leave 1 inch (2.5cm) between sample containers and the chamber walls.

This is the final step in the **Preparing the Incubator procedure**.

ACCESSORY COMPATIBILITY

Make sure that any accessory equipment used inside the incubation chamber can safely and effectively operate within your selected range of temperature, humidity, and CO_2 levels. Some equipment types, such as stirrers or shakers, can generate heat sufficient to disrupt the thermal uniformity and stability of the chamber.

DATA OUTPUT CAPABILITIES

Each incubator generates data outputs describing temperature and CO_2 percentages levels as a digital log line, once per minute. These outputs are transmitted through a USB-style RS232 serial port located adjacent to the power cord inlet on the back of each incubator unit. A software driver and data logging package for the port can be downloaded from the Shel Lab website. **The driver software is required to use the port**. To download the software, visit the **product pages of the SCO5A or SCO10A incubators**, and click on the large USB bar icon titled “USB Software for CO_2 Incubators” located approximately halfway down the page**.**

http://shellab.com/product/sco5a-shel-lab-co2-air-jacketed-incubator-infrared-ir-sensor-5-cu-ft-120v/

USB-Style Serial Port Output

Parameter	Output Channel
Temperature	C1
CO_2	C3

Example logline for the USB-style serial port output:

C1=37.0 C3=5.0

Continued on next page

The temperature and CO_2 levels are also outputted as analog signals by an internal 4-20 milliamp board. These can be connected to a building management system (BMS) or other data monitoring and capture system through the use of two jack ports on the back of each incubator unit. These ports accept standard audio jacks available from most electronics retailers. These are also known as ¼ inch 2-pole audio connectors or phono jacks. Jacks are **not** included with the incubator.

Data Monitoring Systems – Max Resistance

For building management and other data monitoring or logging systems, the maximum resistance of the current loop driven by either output from the 4-20mA module is 250 Ohms. At higher loop resistances the current value will be erroneously low for parameter values near the top of the scale.

Figure 19: Data Jack Ports

Jack Outputs:

Parameter	Parameter Value at 4mA	Parameter Value at 20mA
Temperature	0°C	70°C
CO_2	0% CO_2	20% CO_2

CONDENSATION AND THE DEW POINT

Relative humidity inside the incubator chamber should never be allowed to exceed 95%. Exceeding this threshold will likely result in condensation, possible leaks around the incubator, and may cause corrosion damage if allowed to continue for any significant length of time.

Condensation takes place whenever the humidity level in the incubator chamber reaches the dew point. The dew point is the level of humidity at which the air cannot hold more water vapor. The warmer the air, the more water vapor it can hold.

As the level of humidity rises in an incubation chamber, condensate will first appear on surfaces that are cooler than the air temperature. Near the dew point, condensate forms on any item or exposed surface even slightly cooler than the air. When the dew point is reached, condensate forms on nearly all exposed surfaces.

Managing condensation primarily depends on either lowering the humidity level or increasing the air temperature in the incubator chamber.

Note: Rising or falling air pressure from the weather will adjust the dew point up and down in small increments. If the relative humidity in the incubation chamber is already near the dew point, barometric fluctuations may push it across the dew point threshold.

Note: Thin air at higher altitudes holds less humidity than the denser air found at or near sea level.

If excessive condensate has appeared in the incubation chamber, dry the chamber interior and check the following.

- Verify that the access port stopper is in place, on the inside of the incubation chamber and not the unit exterior.
- Make sure samples on the shelves are evenly spaced to allow for good airflow.
- Ensure the chamber door is closing and latching properly.
- Are frequent or lengthy chamber door openings causing significant temperature disruptions and chilling the chamber surfaces? If so, reduce the number of openings.
- Are there are too many open or “breathable” containers of evaporating sample media in the chamber? If so, reduce the number of open sample containers.
- Does the ambient humidity in the room exceed the stated operating range of 80% relative environmental humidity? If so, lower the room humidity.
- Is the incubator exposed to an external flow of cold air, such as an air-conditioning vent or a door to a cooler hallway or adjacent room? Block or divert the air, or reposition the unit.
- Check the door gaskets for damage, wear, or signs of brittleness or dryness. Arrange for replacement of the gaskets if damaged or excessively worn.

Warning: Prior to any maintenance or cleaning of this unit, disconnect the power cord from the power supply.

Avertissement: Avant d'effectuer toute maintenance ou entretien de cet appareil, débrancher le cordon secteur de la source d'alimentation.

CLEANING AND DISINFECTING

If a hazardous material or substance has spilled in the incubator, immediately initiate your site's Hazardous Material Spill Containment protocol. Contact your local Site Safety Officer and follow instructions per the site policy and procedures.

- The unit chamber should be cleaned and disinfected prior to first use.
- Periodic cleaning and disinfection are required to prevent microbiological contamination.
- Do not use spray on cleaners or disinfectants. These can leak through openings and coat electrical components.
- **Do not use chlorine-based bleaches or abrasives; these will damage the chamber liner.**
- Consult with the manufacturer or their agent if you have any doubts about the compatibility of decontamination or cleaning agents with the parts of the equipment or with material contained in it.
- Do not use cleaners or disinfectants that contain solvents capable of harming paint coatings or stainless steel surfaces.

Warning: Never clean the unit with alcohol or flammable cleaners.

Avertissement: Ne jamais nettoyer l'appareil à l'alcool ou avec des nettoyants inflammables.

Cleaning

1. Remove all non-attached incubation chamber accessories (shelves, racks, and any additional items), if present.
2. Clean the chamber interior with a mild soap and water solution, including all corners.
3. Take special care when cleaning chamber sensor probes located at the rear of the chamber on the back wall.
4. Clean all removable accessories and components.
5. Clean and disinfect any attached sample tubing and replace if discoloring is present.
6. Rinse the chamber surfaces and shelving with distilled water and wipe dry with a soft cloth. **Do not use deionized water.**

Disinfecting

Note: Contact your local Site Safety Officer for detailed information on the disinfectants compatible with your cultivation or culturing applications.

Disinfect the incubation chamber on a regular basis. For maximum effectiveness, disinfection procedures are typically performed after cleaning and removal of gross matter contamination.

Perform the following steps to disinfect the incubator:

1. Turn the unit off. Open all doors and carry out your laboratory, clinical, or production space disinfection protocol.
2. If permitted by your protocol, remove all interior accessories (shelving and other non-attached items) from the chamber when disinfecting.
3. Gas concentrations from evaporating disinfecting agents can inhibit growth or cause metabolic symptoms in microbiological sample populations.
    a. Make sure chlorines, amphyls, quaternary ammonias, or any other overtly volatile disinfecting agents have been rinsed or otherwise removed from the chamber surfaces, prior to placing samples in the chamber.
4. Disinfect the incubation chamber using commercially available disinfectants that are non-corrosive, non-abrasive, and suitable for use on stainless steel surfaces.
    a. Disinfect all surfaces in the chamber, making sure thoroughly disinfect the corners.
    b. Do not disinfect the sensor heads.
5. When disinfecting external surfaces use disinfectants that will not damage painted metal or plastic.

MINIMIZING CONTAMINATION EXPOSURE

The following are suggestions for minimizing exposure of the incubator chamber to potential contaminants.

- Maintain a high air quality in the laboratory workspaces around the incubator.
- Avoid placing the incubator near sources of air movement such as doors, air vents, or high traffic routes in the workspace.
- Minimize the number of times the incubator chamber door is opened during normal operations.

GAS LINES AND HEPA FILTERS

Replace the in-line gas HEPA filter once per year or when a filter is noticeably discolored.

- HEPA filters are directional, and must be installed facing in the correct direction. The word “IN” is stamped on the rim of the filter assembly on the side that faces the gas supply.
- Gas lines should be replaced when cracking, brittleness, permanent kinking, or other signs of damage are present. Please see the **Parts List** on 54.

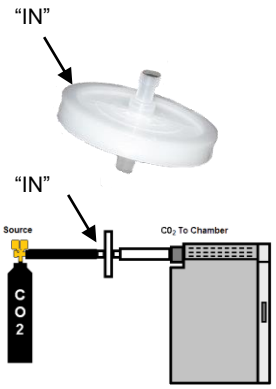


Figure 20: In-Line Gas Filter

STORAGE OF THE INCUBATOR

Perform the following steps if the incubator will be out of use for more than 24 hours to prevent microbiological contamination such as, fungus or mold.

6. Depower the incubator.
7. Disinfect and clean if required by your laboratory protocol, or if the chamber has been exposed to pathogenic microorganisms.
8. Use a soft cloth to dry the chamber surfaces.
    a. Do not place the incubator into storage while the chamber surfaces are damp.

MAINTAINING ATMOSPHERIC INTEGRITY

Periodically, inspect the door latch, trim, catch, and gaskets for signs of deterioration. Failure to maintain the integrity of the door system shortens the life span of the incubator.

ELECTRICAL COMPONENTS

Electrical components do not require maintenance. If the incubator fails to operate as specified, please contact your distributor or **Sheldon Technical Support** for assistance (please see page 7).

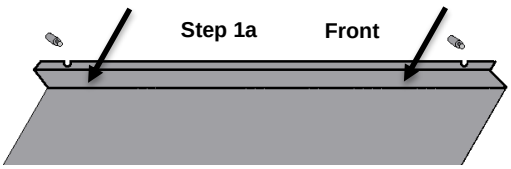
REPLACE THE CHAMBER HEPA FILTER

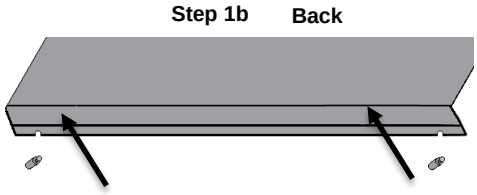
Note: Always turn off and unplug the incubator before carrying out this procedure.

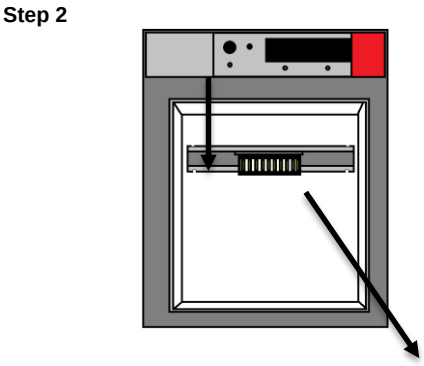
The manufacturer recommends replacing the filter at least once per year or whenever there is noticeable discoloration of the filter media or reduced airflow into the chamber. The lifespan of the filter varies greatly by local air quality and exposure rates.

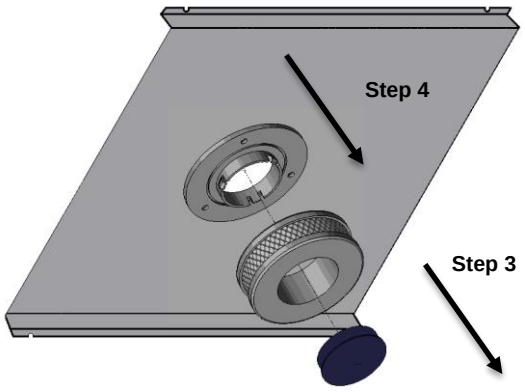
Carry out the following steps to replace the chamber HEPA filter. **Exercise caution:** A plastic blower fan and the fragile head of the temperature and CO_2 sensors are located just above the duct on the right side.

1. Dismount the air duct (ceiling liner).
    a. Use firm but careful pressure to remove the duct from the front mounting pins, one pin at a time.
    b. Dismount the back of the duct from the rear mounting pins.
2. Remove the duct from the chamber.
    a. Lower the front of the duct. This safeguards the blower fan and sensor heads.
    b. Pull the duct and attached HEPA filter out of the incubation chamber.
3. Remove the black plastic cap from the HEPA filter by pulling down on it.
4. Remove the old HEPA filter by pulling down. It will snap out without difficulty.
5. Snap the new HEPA filter into position on the duct. It may be necessary to tilt it slightly to one side.
    a. See the Installing the **Chamber Air Duct and HEPA** filter on page 16 for detailed instructions on reinstalling the filter and duct.
6. Snap the black plastic cap back into position in the center of the HEPA filter.
7. Reinstall the air duct.









CALIBRATE THE TEMPERATURE DISPLAY

Note: Performing a temperature display calibration requires a temperature reference device. Please see the **Reference Sensor Devices entry** on page 12 for device requirements.

Temperature calibrations ensure the incubator temperature display shows the actual air temperature inside the incubation chamber. The actual air temperature is supplied by a reference sensor device. If a difference is detected, a calibration correction is entered to match the display to the reference reading. Calibrations compensate for drifts in the unit microprocessor controller as well as those caused by the natural material evolution of its sensor probe in the heated and humidified chamber atmosphere. Calibrate as often as required by your laboratory or production protocol, or regulatory compliance schedule. The incubator was calibrated at the factory at 37°C.

CO_2

A CO_2 calibration may be conducted simultaneously with a temperature calibration **as long as the chamber door is not opened** during either procedure.

Probes

A reference device sensor probe may be introduced through the access port. Carefully place the port stopper over any probe wires (see Figure 21). Probes may also be introduced through the chamber door space. Use non-stick, non-marking tape to secure the wires and probe heads and seal any gaps. The door must close and latch fully.

Figure 21: Introducing a sensor probe through the access port.

Place the sensor probe of the temperature reference device inside as close as possible to the geometric center of the chamber. A thermocouple sensor probe sleeve may be taped to the shelving, as long as the exposed copper end is 2 inches (5cm) away from the shelf (see Figure 22). An exposed sensor probe in direct contact with the shelving may experience heat sinking, which can result in an inaccurate temperature reading.

Stability

Prior to a calibration, **the chamber should operate undisturbed at its application temperature set point for 8 hours in order to stabilize**. A common practice is to introduce and place the temperature sensor probe in the chamber, allow the unit to operate and stabilize overnight, and then conduct the calibration the next day.

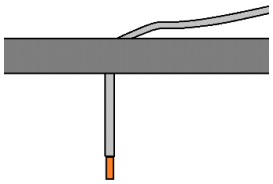
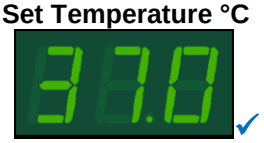
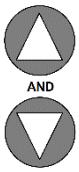
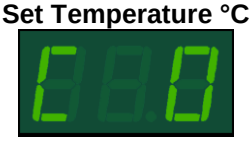


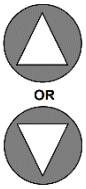
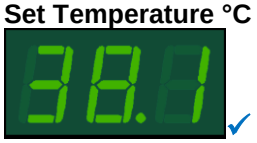
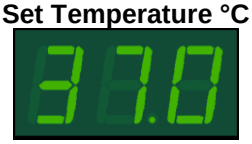
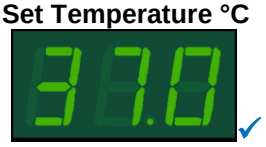
Figure 22: Probe End 2 inches (5cm) From Shelf Surface

The chamber is considered stabilized when it has operated for **1 hour** with no fluctuations ±0.1°C or greater. Failure to wait for stabilization will result in an inaccurate calibration and incubator temperature display reading. If the chamber door is opened during the calibration, the chamber must be allowed to re-stabilize before continuing.

Procedure continued on next page

Temperature Calibration	
1. Once the chamber temperature has stabilized, compare the reference device and temperature display readings. a. If the readings are the same, or if a difference between the two (2) falls within the acceptable range of your protocol, the display is accurately showing the chamber air temperature. **The Temperature Calibration procedure is now complete**. b. If a difference falls outside of your protocol range, advance to step 2.	**Reference Device**  **Set Temperature °C** 
2. A display calibration adjustment must be entered to match the display to the reference device. See next step.	**Reference Device**  **Set Temperature °C** 
3. Place the temperature display in its calibration mode.  a. Press and hold both the **UP and DOWN** temperature arrow buttons simultaneously for approximately 5 seconds. b. Release the buttons when the temperature display shows the letters “CO”. The display will begin flashing the **current temperature display value**. **Note**: If an arrow button is not pressed for five seconds, the display will cease flashing, and store the last displayed value as the new current chamber temperature value.	**Set Temperature °C**  **Set Temperature °C** 

Continued on next page

Temperature Calibration (Continued)	
 4. Use the **Up** and **Down** arrow buttons to adjust the current display temperature value until it matches the reference device temperature reading.	**Reference Device**  **Set Temperature °C** 
 5. After correcting for the difference, wait 5 seconds. a. The temperature display will cease flashing and store the corrected chamber display value. b. The incubator will now begin heating or passively cooling in order to reach the set point with the corrected display value.	**Set Temperature °C**  **Adjusting to Set Point**
 6. Allow the incubator to operate undisturbed for at least one 1 hour to stabilize after it has achieved the set point **with the corrected display value**. a. Failure to wait until the incubation chamber is fully stabilized will result in an inaccurate reading.	**Set Temperature °C** 
7. Compare the reference device reading with the incubator temperature display again. a. If the reference device and the incubator temperature display readings are the same or the difference falls within the range of your protocol, **the incubator is now calibrated for temperature**. b. See the next step if the readings fail to match or fall outside of your protocol range.	**Reference Device**  **Set Temperature °C** 

Continued on next page

Temperature Calibration (Continued)	
8. If a difference still falls outside the acceptable range of your protocol, repeat steps 3 – 7 up to two more times. a. Three calibration attempts may be required to successfully calibrate units that are more than ±2°C out of calibration.	**Reference Device**  **Set Temperature °C** 
9. If the temperature readings of the incubator and the reference device still fall outside your protocol after three calibration attempts, contact your distributor or **Technical Support** for assistance.	

End of procedure

CALIBRATE THE CO_2 DISPLAY

Note: Performing a CO_2 display calibration requires a gas reference device. Please see the **Reference Sensor Devices entry** on page 12 for the device requirements.

CO_2 calibrations are performed to match the incubator CO_2 display to the actual gas concentration in the incubation chamber. The actual concentration is supplied by a calibrated reference sensor device. Calibrations compensate for drifts in the unit microprocessor controller, as well as those caused by the natural material evolution of the IR CO_2 sensor when continually exposed to a heated and humidified atmosphere with elevated CO_2 concentrations. Calibrate as often as required by your laboratory or production protocol, or regulatory compliance schedule.

CO_2 Supply

The incubator must be powered, the CO_2 set point set, and the chamber supplied with CO_2 for at least two hours prior to the calibration.

Temperature

Temperature helps drive gas diffusion in the chamber. CO_2 calibrations must be performed with the chamber fully heated and stable at your operational temperature set point. A CO_2 display calibration may be performed during a temperature calibration **as long as the chamber door is not opened during either procedure**.

Humidity

Because humidity impacts CO_2 concentration through its influence on temperature stability and uniformity, the CO_2 display should be calibrated with the chamber humidified.

Probes

Connect a digital CO_2 analyzer sample tube to the sample port, located on the right side of the incubator, adjacent to the control panel.

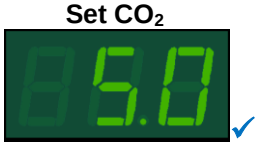
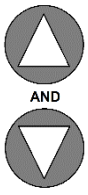
Figure 23: CO_2 Sample Port

Stability

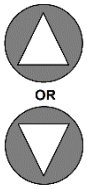
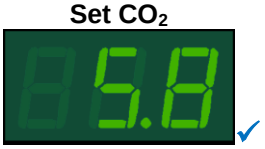
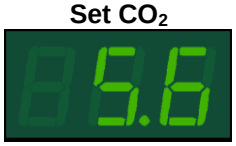
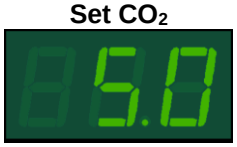
Prior to a calibration, the chamber must operate at its CO_2 set point for **at least 1 hour with no fluctuations** of ±0.1% or greater in order to be considered stabilized. Failure to wait for stabilization will result in an inaccurate calibration and incubator display reading.

For best results, allow the unit to operate undisturbed for 8 hours supplied to achieve temperature and RH stability (for example, overnight). A continual CO_2 supply stream may be introduced a minimum of 2 hours, with the incubator otherwise undisturbed, prior to performing the calibration. If the chamber door is opened during the calibration, the chamber must be allowed to re-stabilize before continuing.

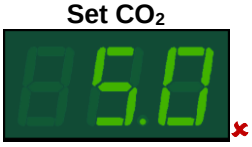
Continued on next page

Calibrate the CO_2 Display	
1. Once the incubation chamber has stabilized with no fluctuations of 0.1% or greater, compare the gas reference device and chamber CO_2 display readings. a. If the readings are the same, or a difference between the two (2) falls within the acceptable range of your protocol, the display is accurately showing the chamber CO_2 concentration. **The CO_2 calibration procedure is now complete**. b. If there is a difference between the two readings that falls outside the acceptable range of your protocol see the next step.	**Reference Device**  **Set CO_2** 
2. A display calibration adjustment must be entered to match the incubator CO_2 display to the reference device.	**Reference Device**  **Set CO_2** 
3. Place the display in its CO_2 calibration mode.  a. Press and hold both the **UP and DOWN** Set CO_2 arrow buttons simultaneously for approximately 5 seconds. b. Release the buttons when the display shows the letters “CO”. The display will begin flashing the **current CO_2 display value**. **Note:** If an arrow button is not pushed for 5 seconds, the display will cease flashing, and store the last displayed value as the new current chamber CO_2 value.	**Set CO_2 %**  **Set CO_2 %**  **Flashing Display Value**

Procedure continued on next page

Calibrate the CO_2 Display (Continued)	
 4. Use the **Up** or **Down** arrow buttons to adjust the current CO_2 display value until it matches the reference device CO_2 reading.	**Reference Device**  **Set CO_2** 
5. After matching the display to the reference device, wait 5 seconds.  a. The display will cease flashing and store the corrected display value. b. The incubator will begin injecting CO_2 or allow the current gas concentration to decay in order to achieve the set point with the corrected display value.	**Set CO_2**  **Adjusting to Set Point**
6. Allow the incubator to operate undisturbed for at least 1 hour undisturbed to stabilize after it has achieved the CO_2 set point **with the corrected display value**.  a. Failure to wait until the unit is fully stabilized will result in an inaccurate reading and calibration.	**Set CO_2** 
7. Compare the reference device reading with the incubator CO_2 display again. a. If the reference device and the CO_2 display readings are the same or the difference now falls within the range of your protocol, **the incubator is now calibrated for CO_2**. b. See next step if the difference still falls outside your protocol range.	**Reference Device**  **Set CO_2** 

Procedure continued on next page

CO_2 Calibration (Continued)	
8. Repeat steps 3 – 7 up to two more times if there is a difference that still falls outside your protocol range. a. Three calibration attempts may be required to successfully calibrate units that are more than ±2% out of calibration.	**Reference Device**  **Set CO_2** 
9. If the CO_2 readings of the display and the reference device still fall outside your protocol after three calibration attempts, contact your distributor or **Technical Support** for assistance.	

End of procedure

UNIT SPECIFICATIONS

The SCO Incubator is a 110 – 120 volt unit. Please refer to the incubator data plate for individual electrical specifications.

Technical data specified applies to units with standard equipment at an ambient temperature of 25°C and a voltage fluctuation of ±10%. The temperatures specified are determined in accordance to factory standard following DIN 12880 respecting the recommended wall clearances of 10% of the height, width, and depth of the inner chamber. All indications are average values, typical for units produced in the series. We reserve the right to alter technical specifications at all times.

WEIGHT

Model	Shipping	Unit
SCO5A	245 lbs / 111.1 kgs	200 lbs / 91.0 kg
SCO10A	466 lbs / 211.4 kgs	398 lbs / 180.5 kgs

DIMENSIONS

By inches

Model	Exterior W × D × H	Interior W × D × H
SCO5A	27.25 x 28.5 x 37.75	20.5 x 19.7 x 21.5
SCO10A	27.25 x 28.5 x 75.5	20.5 x 19.7 x 21.5*

*Interior dimensions for the SCO10A are for each chamber

By centimeters

Model	Exterior W × D × H	Interior W × D × H
SCO5A	69.2 x 72.4 x 96.0	52.07 x 50.17 x 54.61
SCO10A	69.2 x 72.4 x 192.0	52.07 x 50.17 x 54.61*

*Interior dimensions for the SCO10A are for each chamber

Access Port All Units

Diameter
1.45 inches (3.68 cm)

UNIT SPECIFICATIONS (CONTINUED)

CAPACITY

Model	Cubic Feet	Liters
SCO5A	5	142.7
SCO10A	10	285.4

CO_2

Range	Accuracy	Recovery Time
0 – 20%	± 0.1%	Less than 5 minutes

TEMPERATURE

Range	Uniformity	Stability
Ambient +5ºC to 60ºC	± 0.25ºC at 37ºC	± 0.1°C @ 37°C

POWER

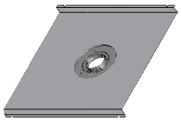
Model	AC Voltage	Amperage	Frequency
SCO5A	110 - 120	6.0	50/60 Hz
SCO10A	110 - 120	12.0 (6.0 Each Incubator Unit)	50/60 Hz

PRESSURE CONVERSION CHART

Conversion table for pressure units

	kPa	MPa	kgf/cm^2	bar	psi	mmHg (Torr)	inHg	atm
1 kPa	1	1×10^{-3}	1.01972×10^{-2}	1×10^{-2}	1.45038×10^{-1}	7.50062	0.2953	9.86923×10^{-3}
1 MPa	1×10^{3}	1	1.01972×10	1×10	1.45038×10^{2}	7.50062×10^{3}	0.2953×10^{3}	9.86923
1 kgf/cm^2	9.80665×10	9.80665×10^{-2}	1	9.80665×10^{-1}	1.42234×10	7.35559×10^{2}	2.8959×10	9.67841×10^{-1}
1 bar	1×10^{2}	1×10^{-1}	1.01972	1	1.45038×10	7.50062×10^{2}	2.953×10	9.86923×10^{-1}
1 psi	6.89473	6.89473×10^{-3}	7.03065×10^{-2}	6.89473×10^{-2}	1	5.17147×10	2.036	6.80457×10^{-2}
1 mmHg (1 Torr)	1.33322×10^{-1}	1.33322×10^{-4}	1.35951×10^{-3}	1.33322×10^{-3}	1.93368×10^{-2}	1	3.9370×10^{-2}	1.31579×10^{-3}
1 inHg	3.3864	3.3864×10^{-3}	3.4531×10^{-2}	3.3864×10^{-2}	0.4912	2.5400×10	1	3.342×10^{-2}
1 atm	1.01325×10^{2}	1.01325×10^{-1}	1.03323	1.01325	1.46960×10	7.60000×10^{2}	2.9921×10	1

PARTS LIST

Part	Part Number	Part	Part Number
Access Port Stopper, Size 6	 7750514	Gas Line HEPA Filter	 2800525
Chamber HEPA FILTER	 2800517	Humidification Pan	 995-00015
Chamber HEPA Filter Cap	 6500606	Leveling Foot	 2700512
Ceiling Air Duct (Chamber)	 5121527	Power Cord 114 volt 15 Amp,9ft 5 in (2.86m) NEMA 5-15P	 1800510
CO_2 Gas Tubing Kit with In-Line HEPA Filter	 9710500	Shelf Slides	 5121526
Copper Token, Humidification Pan	 5800529	Shelf Standards	 5170646
Fuse T10A 250V 5X20mm	 3300515	Shelf	 5121525

ORDERING PARTS AND CONSUMABLES

If you have the Part Number for an item, you may order it directly from Sheldon Manufacturing by calling 1-800-322-4897 extension 3. If you are not certain that you have the correct Part Number, or if you need that specific item, please contact Sheldon Technical Support for help at 1-800-322-4897 extension 4 or (503) 640-3000. Please have the **model number** and **serial number** of the incubator ready, as Tech Support will need this information to match your unit with its correct part.

ACCESSORIES

The following accessory is available for the SCO5A and SCO10A Incubators.

CO_2 Cylinder Regulator, Dual Stage

For use with a gas supply cylinder (tank).

Part Number 7150509

Copper Shelf Assembly

Three copper shelves. Includes six copper shelf slides. Copper is known to have antimicrobial properties.

Part Number: 9750582 complete assembly described above.

PN 5820504 Individual Shelf PN 5820505 Individual Slide

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Cornelius, Oregon 97113
EMAIL: tech@Shellab.com
INTERNET: http://www.Shellab.com
PHONE: 1-800-322-4897 (503) 640-3000
FAX: (503) 640-1366

SHELLAB®