AIR-JACKETED CO_2 INCUBATOR 110 - 120 Voltage

SHEL LAB®

Installation and Operation Manual

SCO10A SCO5A

Previously Designated:

5230 5215

SCO5A SCO10A AIR-JACKETED CO_2 INCUBATORS

Installation and Operation Manual

Part Number (Manual): 4861730

Revision: June 10, 2015

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.

These units have been tested to the following requirements:

CAN/CSA C22.2 No. 61010-1:2012
CAN/CSA C22.2 No. 61010-2-010 + R:2009
UL 61010A-2-010:2002
UL 61010-1:2012
EN 61010-1:2010
EN 61010-2-010:2003

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INTRODUCTION

Thank you for purchasing a Sheldon Manufacturing, Inc. Air-Jacketed CO_2 Incubator. 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 unit, always follow basic safety precautions including:

- Always plug the unit power cord into an earth grounded electrical outlet that conforms to national and local electrical codes. If the unit is not grounded properly, parts such as knobs and controls can conduct electricity and cause serious injury.
- Avoid damaging the power cord. Do not bend it 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.
- Always position the unit so that end-users 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.
- 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 unit. 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

RECEIVING YOUR INCUBATOR

When an incubator 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 incubator inspect it for concealed loss or damage to the interior and exterior. If you find damage, **follow the carrier's procedure for claiming damage or loss**.

INSPECTING THE SHIPMENT

Before leaving the factory, SCO incubators are packaged in high-quality shipping materials to provide protection from transportation-related damage.

Carefully inspect the shipping carton for damage. Report any damage to the carrier service that delivered the incubator. If the carton is not damaged, open the carton and remove the contents. Carefully check all packaging before discarding. Save the shipping carton until you are certain that the unit and its accessories function properly.

Inspect the incubator for damage. The orientation photos on pages 10 and 11 can serve as useful visual references.

The unit should come with an Installation and Operation Manual and a Certificate of Compliance. Verify that the correct number of accessories are present.

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

6500506

CO_2 Tubing Kit

9710500

CO_2 HEPA Filter

2800525

1 Humidification Pan

995-00015

4 Leveling Feet

2700512

1 Power Cord

1800510

6 Shelf Slides

5121526

4 Shelf Standards

5170646

3 Shelves

5121525

RECEIVING (CONTINUED)

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 Chamber Filter Caps

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2 CO_2 Tubing Kits

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995-00015

4 Leveling Feet

2700512

2 Power Cords

1800510

12 Shelf Slides

5121526

8 Shelf Standards

5170646

6 Shelves

5121525

The incubator can be connected to a building CO_2 gas 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 56 if you wish to order one from Shel Lab.

9740558

Figure 1: Optional CO_2 Regulator

ORIENTATION PHOTO

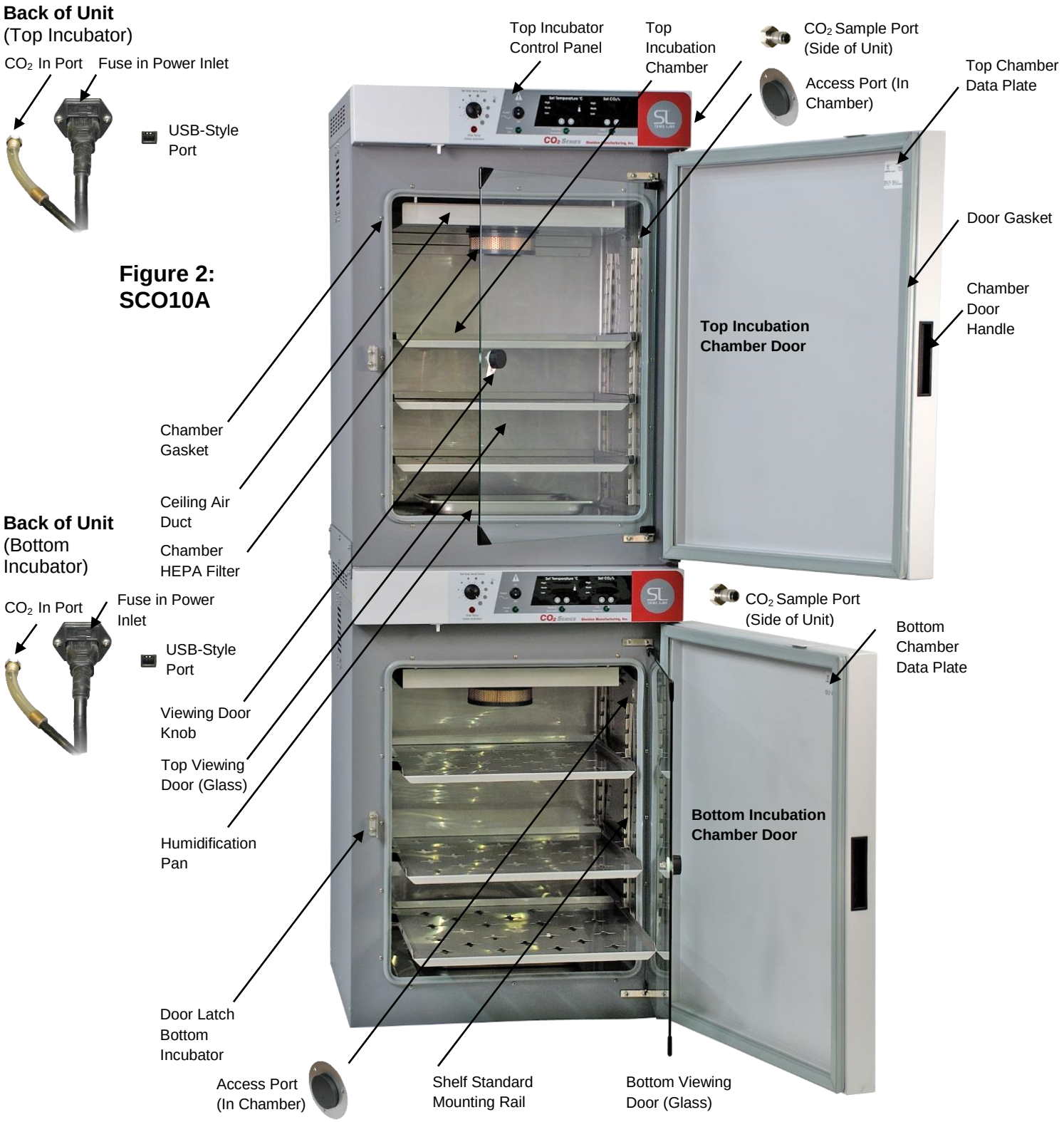


Figure 2: SCO10A

Back of Unit

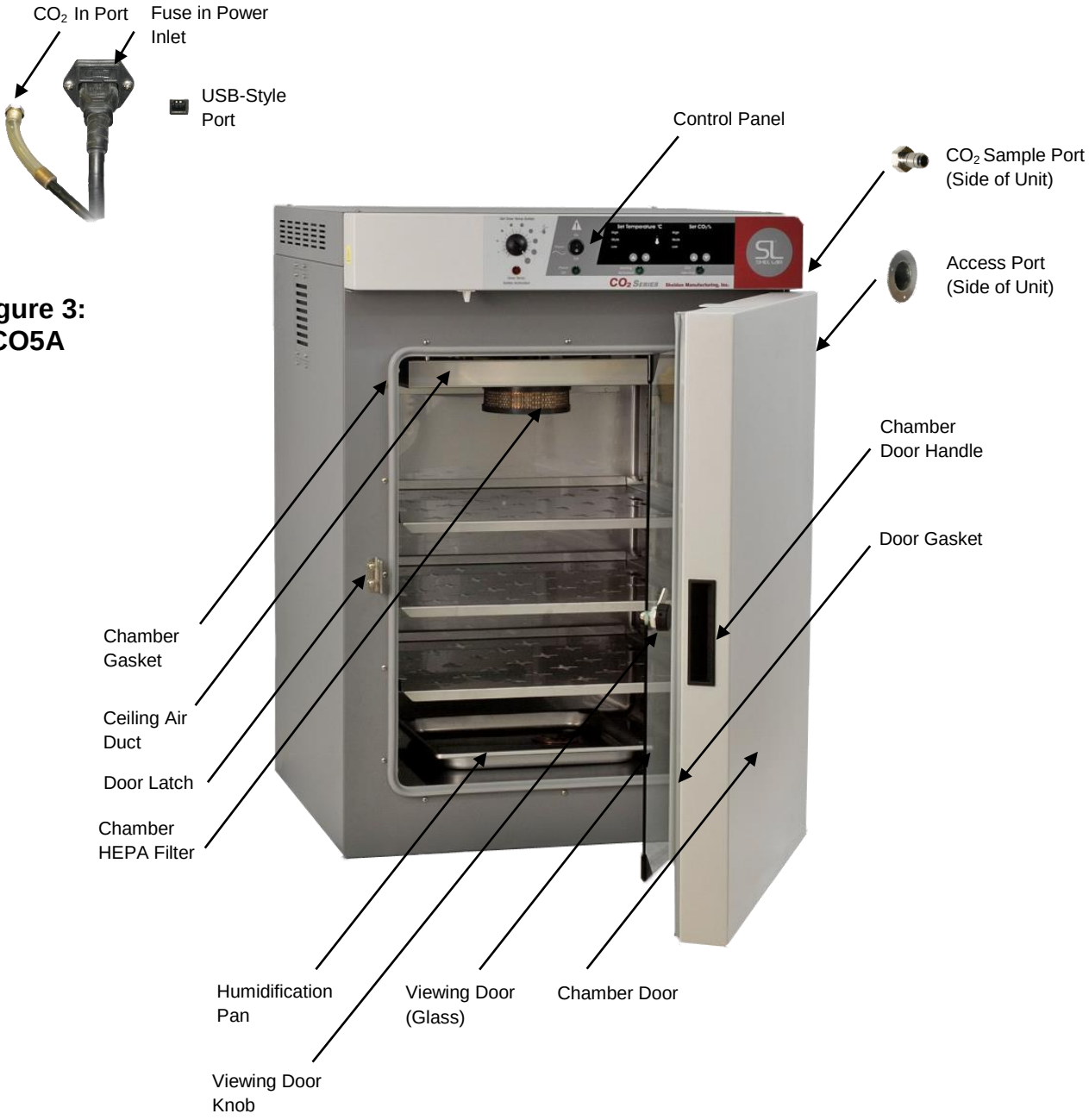


Figure 3: SCO5A

RECORDING DATA PLATE INFORMATION

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

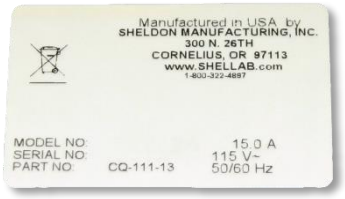


Figure 4: Data Plate

The SCO10A is provided with additional individual incubator chamber data plates on the top right corner of each incubation chamber door interior. You do not need to record 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 for performing display accuracy verifications or calibrations for incubation chamber temperature and CO_2 concentration.

Reference devices must be accurate to at least 0.1°C and 0.1% CO_2, and should be regularly calibrated, preferably by a third party. For best results, use a digital device with wired-connected temperature sensing probe that can be placed in the incubation chamber through the unit access port(s). For example: a wire thermocouple probe. A gas analyzer should have sample tubing that can be connected to the incubator external CO_2 sample port. Readings that avoid chamber door openings during verification and calibration eliminates 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. Each incubator in the SCO10A must be calibrated separately.

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

AMBIENT CONDITIONS

The 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). Allow a minimum of **4 inches (10cm)** between the incubator and walls or partitions, and **2 inches (5cm)** of 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 FACTORS

When selecting a location to install the incubator, consider all environmental conditions that can affect 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 voltage and ampere requirements listed on the unit data plate.
- **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%.
- Wall power sources must be earth grounded.
- The unit must be positioned so that all end-users can quickly unplug power cords in the event of an emergency.
- The wall power sources must conform to all national and local electrical codes.
- Use a separate circuit to prevent loss of product due to overloading or circuit failure.
- The unit is provided with a 250V time-lag T 10 amp 5x20mm fuse located in **each** power inlet.
- 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).
- These units are intended for 110 – 120 VAC 50/60 Hz applications at 6.0 amps.

LIFTING AND HANDLING

The unit should only be lifted by its bottom surfaces using proper heavy lifting machinery such as, a forklift or pallet jack. Handles and knobs are inadequate for lifting or stabilization. The unit should be completely restrained from tipping during lifting. Transporting the unit while lifted is not recommended and may be hazardous. Remove all moving parts, such as shelves and trays, and secure the door in the closed position prior to lifting the unit.

Do not attempt to move the unit while in operation or before the unit has cooled.

LEVELING

The unit must be level and stable for safe operation. Each unit ships with four leveling feet.

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.

Figure 5: Leveling Foot

To prevent damage to the feet while in transport turn all feet to the maximum counterclockwise position.

INSTALL INCUBATOR IN LOCATION

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

DEIONIZED AND DISTILLED WATER

Do not use deionized water to clean or humidify the incubator. Use of deionized water may corrode metal surfaces and voids the warranty. Sheldon Manufacturing 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 and humidifying applications.

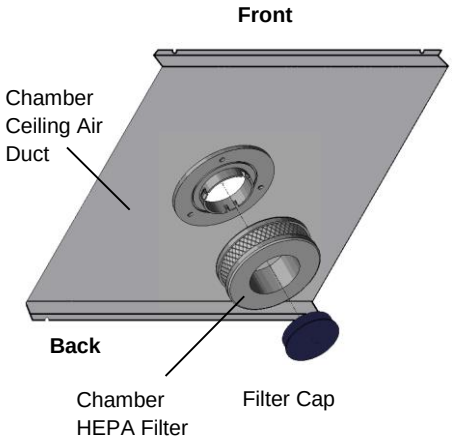
INSTALLATION (CONTINUED)

INSTALLATION CLEANING AND DISINFECTION

If required by your laboratory protocol, clean and manually disinfect the incubator chamber and shelving components. Cleaning and disinfecting during installation reduces the risk of contamination. The chamber and shelving were cleaned and disinfected at the factory. However, Sheldon Manufacturing cannot guarantee that the incubator was not exposed to contaminants during shipping.

Remove all protective wrappings from shelving components and ceiling air duct prior to cleaning. **Do not clean the chamber HEPA filter!**

Please see the **Cleaning and Disinfecting** entry on page 40 in the User Maintenance section for information on how to clean and disinfect without damaging the incubator or its components.

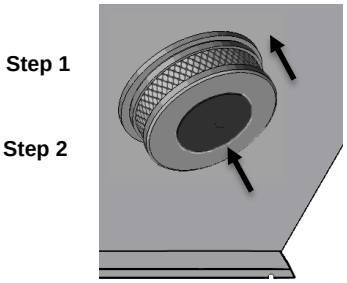


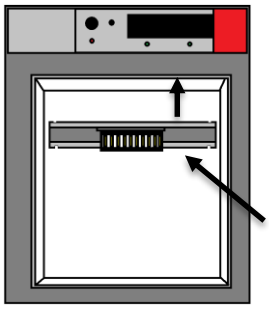
INSTALL CHAMBER HEPA FILTER AND DUCT

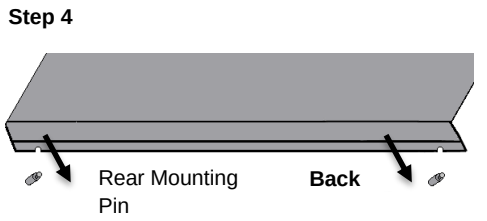
The SCO5A and SCO10A are provided with ring style, screened HEPA filters for each chamber. The filters trap particulates, as well as isolate and kill airborne microbes. The lifespan of the filter varies greatly by air quality and exposure rates. Sheldon Manufacturing recommends replacing the filter at least once per year, and more often if there is noticeable discoloration of the filter media or reduced airflow into the chamber.

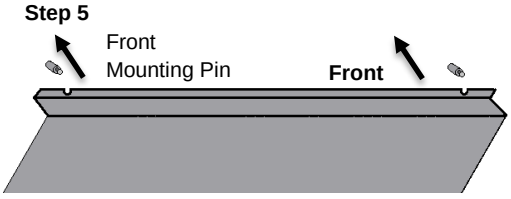
Carryout the following steps to install or the filter and ceiling air duct. Always turn off and unplug the incubator before carrying out this procedure.

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.
    a. Use firm but careful pressure when mounting the duct on the front pins. This to prevent the duct from hitting the blower fan wheel and sensor heads adjacent to the duct.









INSTALLATION (CONTINUED)

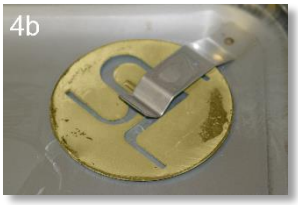
SHELVING INSTALLATION

Install the shelving and humidification pan in the in the incubation chamber. Always install the copper token in the pan. Copper is known to have antimicrobial properties, which retards the growth of microorganisms in the pan.

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 with the bent ends facing up in the back and down in the front.



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.

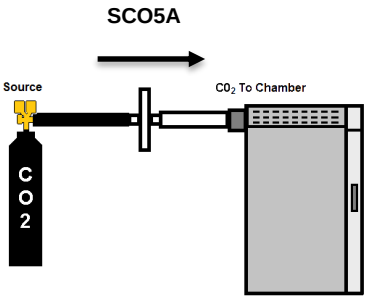
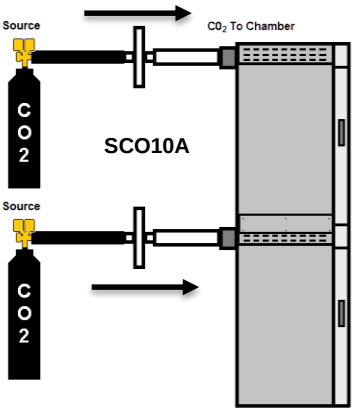


Figure 6: CO_2 Supply Source Connections



The incubator may be connected to either a building CO_2 supply source or a gas supply cylinder (tank). During normal operations the incubator uses only small quantities of CO_2 to maintain the chamber gas concentration. Precise regulation of the gas input flow is vital for the incubator performance. 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.

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

Please see the **Pressure Units Conversion table** on page 54 in the Unit Specifications section for the formulas for converting psi into other units of pressure measurement.

3. Remove the dust cover from the CO_2 to Chamber on the back of each incubator 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 initiate a flow of CO_2** to the incubator at this time.

Figure 7: CO_2 to Chamber

End of procedure

ACCESS PORT STOPPER

The SCO5A and SCO10A incubators provided with an access port located on the right side of each incubator unit. A rubber access port stopper is shipped in each port. The stopper should always be installed inside the chamber to obtain the best temperature uniformity and prevent condensation from forming inside the port. A second stopper may be installed on the outside of the unit to prevent dust from building up in the port, but is not required.

Figure 8: Port Stopper in Access Port

7750514

Figure 9: Port Stopper

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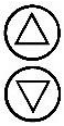
GRAPHIC SYMBOLS

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 user 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)

CONTROL PANEL OVERVIEW

Figure 10: 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.

CONTROL PANEL OVERVIEW (CONTINUED)

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 heated 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 programed 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 a 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 are 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 panel.

Insulation is provide 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 line. 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 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 humidifying 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 is intended to 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 failure of the temperature microprocessor or its sensor probe by rerouting power away from the heating element whenever the temperature in the incubator chamber exceeds the OTL setting. The OTL is provided with an independent hydrostatic temperature probe on the chamber back wall. The system is set **by the end-user** at approximately 1°C above the current chamber temperature, typically when operating at the application temperature. Because of its nature as a mechanical cutoff 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. The OTL System should only be used as a means of heating regulation for the incubation chamber until a failed processor board and its temperature probe can be repaired or replaced.

Note: Setting up the incubator for use in a new workspace environment requires an 8-hour period for the unit to come up to and stabilize at temperature, CO_2, and, humidity levels prior to loading the incubation chamber with samples. During this period the incubator must be powered continually, supplied CO_2, the humidity pan filled, and both the inner and outer doors to each chamber closed. Allowing time for stabilization helps protect samples. It is also necessary for the optional temperature and CO_2 display accuracy verification procedures, as well as any calibrations performed.

PREPARING THE INCUBATOR FOR USE

Perform the following steps and procedures to prepare the SCO5A or SCO10A for use each time it is installed in a new workspace environment:

1. A clean and disinfected thermocouple probe for performing the optional temperature display accuracy verifications may be inserted through the access port at this time. This saves time by allowing the unit chamber temperature to stabilize prior to the verification procedure.

    a. See the optional **Temperature Display Accuracy Verification procedure** on page 32 for the correct introduction and placement of the thermocouple probe.

2. Verify that the side access port stopper is in place on the **inside** of each incubator access port.

3. Verify that the workspace power supply and the incubator power requirements listed on the unit data plate have been matched.

    a. See the **Power Source Requirement** entry on page 13.

4. Plug the power cord(s) into the workspace supply outlets.

5. Open the CO_2 supply control or gas regulator so it supplies 15 - 20 psi to each incubator unit.

6. Place the **Power** switch in the on (I) position.

Procedure continued on next page

Note: It may take up to 20 seconds for CO_2 to reach the gas sensor in an SCO Air-Jacketed Incubator after the regulator is opened **and** the incubator is powered up. The CO_2 display will read “LO” until a measurable gas concentration is detected in the chamber.

Preparation Procedure Continued

7. Perform the following procedures in the Operation section for each incubator:

    a. Fill the humidification pan(s) as per **Humidifying the Incubator** page 27

    b. **Set the Temperature Set Point** page 28

    c. **Set the CO_2 Set Point** page 30

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

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

    f. **Set the Over Temperature Limit** page 36

    g. **Load the Chamber** page 37

End of Preparation Procedure

HUMIDIFYING THE INCUBATOR

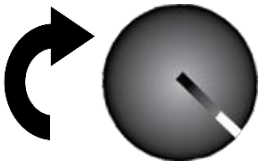
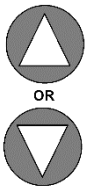
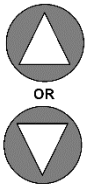
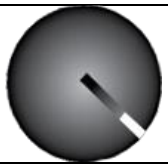
Fill the humidification pan in each incubation chamber. Make sure each pan is placed on its chamber floor. The floors are heated and will help raise the humidity level of each chamber to approximately 90 – 95% relative humidity. This helps slow the drying of samples in open, "breathable" containers.

- 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 the tray.
- Refill as needed, and change the water in the tray at least once per week.
- Use of chemical disinfectants added to the tray 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.**

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 assumes 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. Press and release either of the **temperature arrows** 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 Point Adjustment Mode**  **Initial Set Point**
 OR 3. Use the **Up** or the **Down arrow keys** to adjust the set point to your application temperature.	 **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.	  **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, or 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 fifteen minutes. This prevents the low alarm from sounding whenever the doors are opened, causing a short drop in temperature.

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.
2. The audible alarm component will remain muted for the duration of the **current** temperature deviation. The visual alarm indicator will remain illuminated.
3. Any new deviation of ±1°C or greater will reactivate the audible alarm.

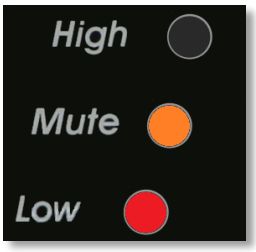


Figure 11: Low Alarm Muted

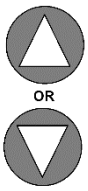
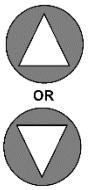
AUTOMATIC DOOR CUTOFF

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 3 to 5%.

 1. Press 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** or 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.  **Wait 5 Seconds** 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 incubator CO_2 level deviates 1% above or below the CO_2 set point. An audible alarm will sound 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.

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

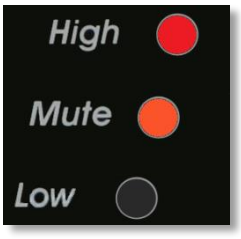


Figure 12: High Gas Alarm Muted

Figure 13: Gas Alarm Timeline

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 several minutes of CO_2 inflow to establish a concentration percentage (%) high enough to deactivate the alarm.

Figure 14: 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: Each incubator is calibrated at the factory at 37ºC. A verification of the display accuracy may be carried out when preparing the incubator for use, if required by your laboratory or production protocol.

If 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.

Humidity

Perform the verification with the chamber fully humidified. The humidity level of the chamber impacts its temperature performance. 8-hours is the recommended time for the unit to achieve and stabilize at its operational relative humidity level from a dry state.

CO_2

A CO_2 display verification may be performed concurrently with the temperature verification.

Probes

Reference device sensing probes may be introduced through the access port. Carefully seat 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 15: 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 16). 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 verification the chamber must operate humidified 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.

For best results, after introducing and placing the temperature probe, allow the incubator to run undisturbed and humidified for 8 hours (for example, overnight) prior to performing the verification.

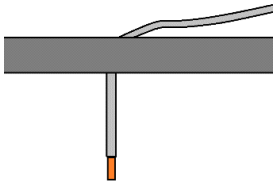


Figure 16: Probe End 2 inches (5cm) From Shelf Surface

Verifying the Temperature Display Accuracy	
1. Once the incubation chamber has stabilized with no fluctuations of 0.1˚C or greater, compare the reference temperature device and chamber temperature display readings. a. If the readings are the same, or the 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.

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

Temperature

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. The incubation chamber should be heated to and running at your application temperature, as temperature drives gas diffusion in the chamber.

Humidity

The incubator should be allowed to come up to humidity in the chamber prior to performing a CO_2 verification. Relative humidity affects CO_2 distribution through its influence on the chamber atmosphere temperature.

Probes

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

Figure 17: CO_2 Sample Port

Stability

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.

For best results, allow the unit undisturbed to run for 8 hours for heat and humidity stability (for example, overnight) after introducing and placing the probes, but prior to performing the verifications. A CO_2 flow may be started to the chamber 2 hours prior to the start of the verification.

Continued on next page

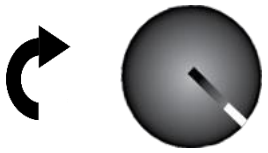
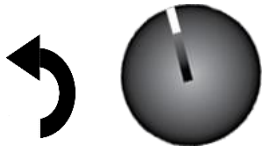
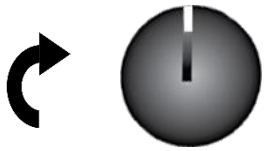
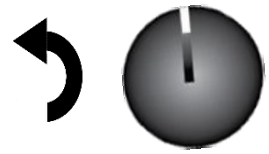
Verifying the CO_2 Display Accuracy	
1. Once the chamber has stabilized with no fluctuations of 0.1% or greater, compare the gas reference device and chamber CO_2 display readings. a. If the readings are the same, or the difference between the two (2) falls within the acceptable range of your protocol, the display is accurately showing the chamber air temperature. **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

The incubator must be operating at your incubation application temperature, and must be stable for at least one hour prior to setting the OTL. Perform the following steps to set up the **Over Temperature Limit** system for use:

	Example
1. If you have not done so already, turn the **Set Over Temperature Limit** control dial clockwise to the maximum position.	
2. Turn the Over Temperature Limit control dial counterclockwise until the red Over Temp 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 is sporadically activating, you may turn the dial very slightly to the right (clockwise).

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. Good 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

The Each air-jacketed SCO incubator generates data outputs describing temperature and CO_2 percentages levels as a digital log line. These outputs are transmitted through a USB-style 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

Analog 4-20 milliamp outputs can also 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 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 18: 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 thresholds 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 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.
- Remove the humidity pan or other open containers of water.
- Are there are too many open 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.

USER MAINTENANCE

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 incubator 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 cleaners or disinfectants that contain solvents capable of harming paint coatings or stainless steel surfaces. **Do not use chlorine-based bleaches or abrasives; these will damage the chamber liner.**

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

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

Do not clean or disinfect the ring-style chamber HEPA filter! Replace the filter if discolored or if you believe it has been contaminated.

Cleaning

1. Remove all non-attached incubation chamber components and 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

Disinfect the incubation chamber on a regular basis. For maximum effectiveness disinfection procedures are typically performed after cleaning and the removal of gross matter contamination. Perform the following steps to manually disinfect the incubator:

1. Turn the unit off. Open all doors and carryout your laboratory, clinical, or production space disinfection protocol.
2. Disinfect the incubation chamber using commercially available disinfectants that are non-corrosive, non-abrasive, and suitable for use on stainless steel surfaces. If disinfecting external surfaces use disinfectants that will not damage painted metal or plastic. Contact your local Site Safety Officer for detailed information on the disinfectants compatible with your cultivation or culturing applications.
3. If permitted by your protocol, remove all interior accessories (shelving and other non-attached items) from the chamber when disinfecting.
4. Disinfect all surfaces in the chamber, making sure thoroughly disinfect the corners. Exercise care to avoid damaging the sensor probes.
5. Gas concentrations from evaporating disinfecting agents can inhibit growth or cause metabolic symptoms in microbiological sample populations. Make sure that 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.

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.

HEPA Filter and Gas Lines

Sheldon Manufacturing recommends replacing in-line gas HEPA filter once per year, or when the 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 toward the gas supply.

Figure 19: In-Line Gas Filter

Gas lines should be replaced when cracking, brittleness, permanent kinking, or other signs of damage are present. Please see the **Parts List** on 55.

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.

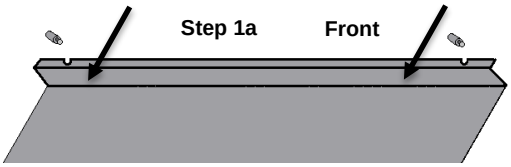
1. Depower the incubator.
2. Disinfect and clean if required by your laboratory protocol, or if the chamber has been exposed to pathogenic microorganism.
3. Use a soft cloth to dry the chamber surfaces.

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.

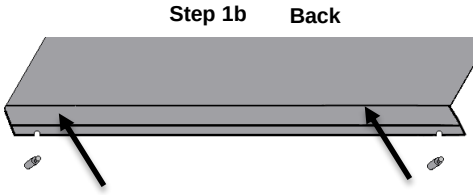
Electrical Components

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).

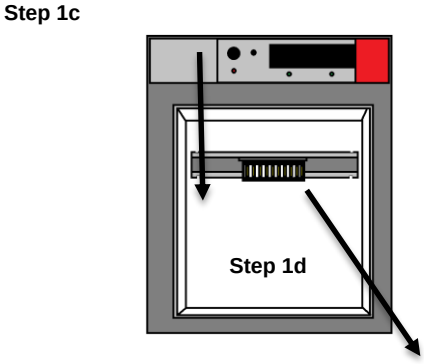


REPLACE THE CHAMBER HEPA FILTER

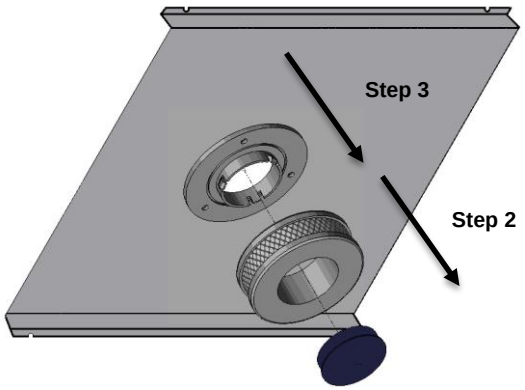
Carryout the following steps to replace the ring-style chamber HEPA filter. Always turn off and unplug the incubator before carrying out this procedure.



1. Remove the air duct (ceiling liner). Exercise caution as a plastic blower fan and the fragile head of the temperature and CO_2 sensors are located just above the duct and to the right of the duct.
    a. Use firm but careful pressure to remove the duct from the front mounting pints, one pin at a time.
    b. Dismount the back of the duct from the rear mounting pins.
    c. Once free of the pins, carefully lower the front of the duct.
        i. This safeguards the blower fan and sensor heads.
    d. Pull the duct and attached HEPA filter out of the incubation chamber.



2. Remove the black plastic cap from the HEPA filter by pulling down on it.
3. Remove the old HEPA filter by pulling down. It will snap out without difficulty.
4. Snap the new HEPA filter into position on the duct. It may be necessary to tilt it slightly to one side.
5. Snap the black plastic cap back into position in the center of the HEPA filter.
6. 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 are performed to match the incubator temperature display to the actual air temperature inside the incubation chamber. The actual air temperature 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 sensor probe in the humidified and heated chamber space. Calibrate as often as required by your laboratory or production protocol, or regulatory compliance schedule.

Humidity

Humidity affects the incubation chamber temperature uniformity. Calibrate with the chamber humidified.

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

Reference device sensing probes may be run through the access port. Carefully seat 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 seal any gaps. The door must close and latch fully.

Figure 20: 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 25). 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 and humidified 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.

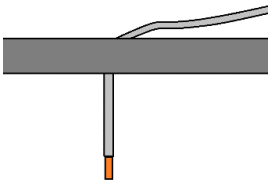
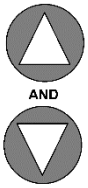


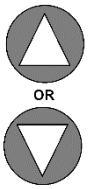
Figure 21: Probe End 2 inches (5cm) From Shelf Surface

Failure to humidify the chamber may result in an inaccurate calibration and display reading.

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.

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 the difference between the two (2) falls within the acceptable range of your protocol, the display is accurately showing the test space 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.  AND 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 key 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** 

Continued on next page

Temperature Calibration (Continued)	
 4. Use the **Up** or **Down** arrows 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 five (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 sit for at last one 1 hour undisturbed to stabilize **after it has achieved the corrected temperature set point**. 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 chamber temperature display again. a. If the reference device and the chamber 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 the two readings are not the same, and the 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 chamber 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

The chamber temperature impacts the chamber CO_2 concentration, due to its influence on gas diffusion. 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

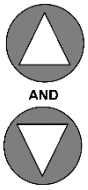
Connect a digital CO_2 analyzer sample tube to the sample port, located on the left side of the incubator near the top.

Figure 22: CO_2 Sample Port

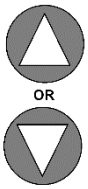
Stability

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.

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 the 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 key is not pressed for five seconds, the display will cease flashing, and store the last displayed value as the new current chamber CO_2 value.	**Set CO_2** 

Procedure continued on next page

Calibrate the CO_2 Display (Continued)	
 4. Use the **Up** or **Down** arrows 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 sit for at last 1 hour undisturbed to stabilize **after it has achieved the corrected CO_2 set point**. 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	± 0.1ºC at 37ºC	± 0.25°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	 6500506	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	3300516	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

Sheldon Manufacturing Inc.
P.O. Box 627
Cornelius, Oregon 97113
EMAIL: tech@Shellab.com
INTERNET: http://www.Shellab.com
PHONE: 1-800-322-4897 (503) 640-3000
FAX: (503) 640-1366

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