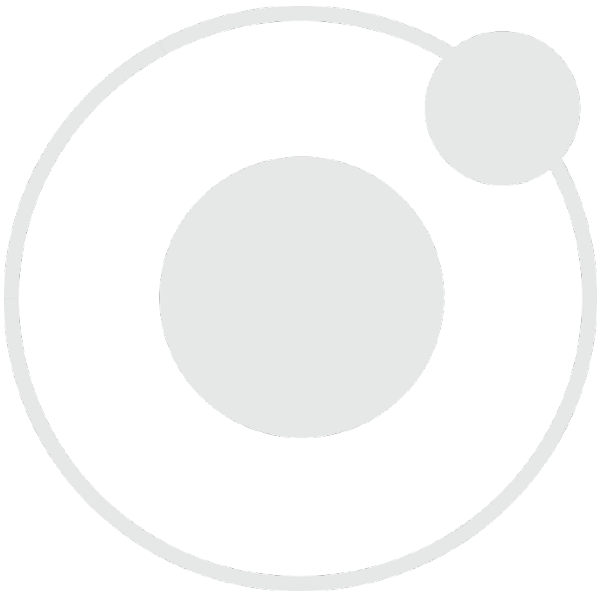
BOD INCUBATOR

SHEL LAB®

110 - 120 Voltage

Installation - Operation Manual

SRI20



SRI20 BOD Incubator

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Installation and Operation Manual

Part Number (Manual): 4861786

Revision: November 10, 2017

SHELDON MANUFACTURING, INC.

These units are compliant with the following standards for use within an ambient air pressure range of 22.14 – 31.3 inHg (75 – 106 kPa), with no flammable, volatile, or combustible materials being heated.

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

TABLE OF CONTENTS

INTRODUCTION

Thank you for purchasing a SHEL LAB incubator. We know you have many choices in today's competitive marketplace when it comes to constant temperature equipment. We appreciate you choosing ours. We stand behind our products and will be here if you need us.

Locations and Applications Range

These incubators are intended for professional, industrial, or educational BOD applications at a constant temperature. The incubators are not designed for use in hazardous or household locations.

User Manual

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

Note: This chamber is **not** designed for the growth, cultivation, incubation, and storage of fruit flies (*Drosophila melanogaster*). Improper use of this unit, including use with fruit flies, can result in corrosion damage to the unit and voids any warrant. Other model types are specifically manufactured for fruit fly applications. Consult your dealer or the manufacturer in order to identify another model suitable for your study.

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's 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 a protective 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.
- 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 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.

SHELDON MANUFACTURING

SHEL LAB is a brand of Sheldon Manufacturing, INC.

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's operating characteristics or appearance differs from those described in this manual, please contact your SHEL LAB dealer or distributor for assistance.

CONTACTING ASSISTANCE

Phone hours for Sheldon Technical Support are 6 am – 4:30 pm Pacific Coast Time (west coast of the United States, UTC -8). Please have the following information ready when calling or emailing Technical Support: the **model number** and the **serial number** (see page 9).

EMAIL: support@sheldonmfg.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

INSPECT THE SHIPMENT

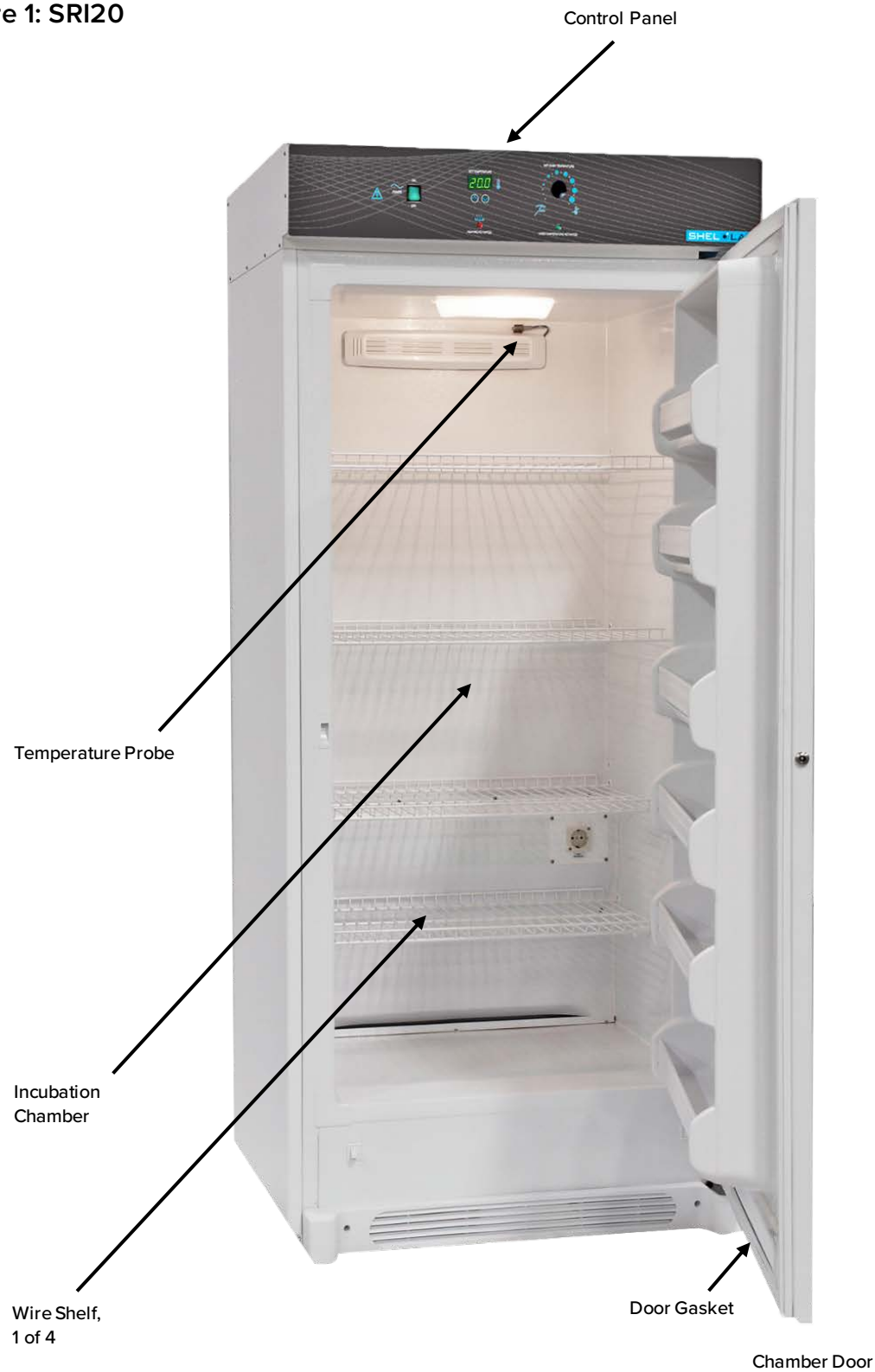
- When a unit leaves the factory, **safe delivery becomes the responsibility of the carrier.**
- Damage sustained during transit is not covered by the manufacturing defect warranty.

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.
    - 4 shelves
    - 1 chamber door key
    - 1 Chamber door handle with installation instructions

Orientation Photo

Figure 1: SRI20



RECORDING DATA PLATE INFORMATION

The unit data plate contains the unit **model number** and **serial number**. Record this information below for future reference.

The data plate is located on the unit exterior, on the top, right side.

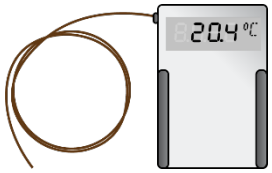
Data Plate Information

Model Number	
Serial Number	

REFERENCE SENSOR DEVICE

Optional: A reference temperature sensor for conducting in-house calibrations of the unit temperature display must be purchased separately from the workstation. The reference device must be accurate to at least 0.1°C. Use a digital device with one or more thermocouple probes suitable for the application temperature you will be verifying and calibrating the display to. Always calibrate to your industry or regulatory compliance standards.

Alcohol thermometers are not accurate enough for conducting verifications and calibrations. **Never place a mercury thermometer in the chamber**.



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INSTALLATION CHECKLIST

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

Pre-Installation

✓ Check that the required ambient conditions, ventilation, and spacing for the incubator are met, page 12.

- Unit dimensions may be found on page 45

✓ Check for performance-disrupting heat and cold sources in the environment, page 12

✓ Check that a suitable electrical outlet and power supply is present, page 13

Install the Incubator in a suitable workspace location

✓ Review the lifting and handling instructions, page 13

✓ Install the incubator in its workspace location, page 13

✓ Make sure the incubator is level, page 14

Set up the Incubator for use

✓ Install the incubator door handle, page 14

✓ Verify that all packaging has been removed from the incubator shelving and incubation chamber, page 15

✓ Clean the incubator if needed, page 16

REQUIRED AMBIENT CONDITIONS

The SRI 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 unit and walls or partitions, and **2.5 inches (6cm)** of clearance above the top of the incubator for unobstructed airflow.

Leave sufficient room in front of the unit for the door to swing freely.

4” (10cm) between the back of the incubator and any wall or other partition.

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

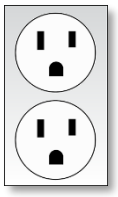
ENVIRONMENTAL DISRUPTION SOURCES

When selecting a location to install the unit, 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 is satisfied:



Power Source: The power source must match the voltage and ampere requirements listed on the unit data plate. These units are intended for **110 - 120 VAC** 50/60 Hz applications at **8 amps**.

- **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 protective earth grounded.
- Use a separate circuit to prevent loss of product due to overloading or circuit failure.
- The wall power sources must conform to all national and local electrical codes.

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

- The unit is provided with an integral 125V, 15 Amp, NEMA 5-15P, 8ft (2.5m) power cord.

Circuit Breaker: The unit is provided with an integral circuit breaker to protect against overcurrent conditions.

- Always determine the cause of an overcurrent event before resetting a tripped circuit breaker.

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.

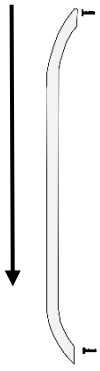
- Handles and knobs are inadequate for lifting or stabilization.
- The unit should be completely restrained from tipping during lifting.
- Transporting the unit while lifted is not recommended and may be hazardous.
- Secure the door in the closed position prior to lifting the unit.
- Do not attempt to move the unit while in operation or before the unit has cooled.

LEVELING

The unit must be level and stable for safe operation. Ensure that the incubator is placed on a flat and level surface, prior to placing the unit in operation.

INSTALL THE INCUBATOR IN LOCATION

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



ATTACH THE INCUBATOR DOOR HANDLE

Attach provided the door handle to the incubator door.

- Use the instructions packaged with the handle.

ADJUST SHELVES

Note: The form factor of the shelves may vary slightly by year of production.

The unit ships with its shelves installed in the incubation chamber. Tape, foam, and other packing dunnage is used to secure the shelves during transit and prevent damage to the chamber interior.

1. Remove all shipping dunnage from the shelving.

Optional: Shelf Adjustment

Move the shelves as needed for your application.

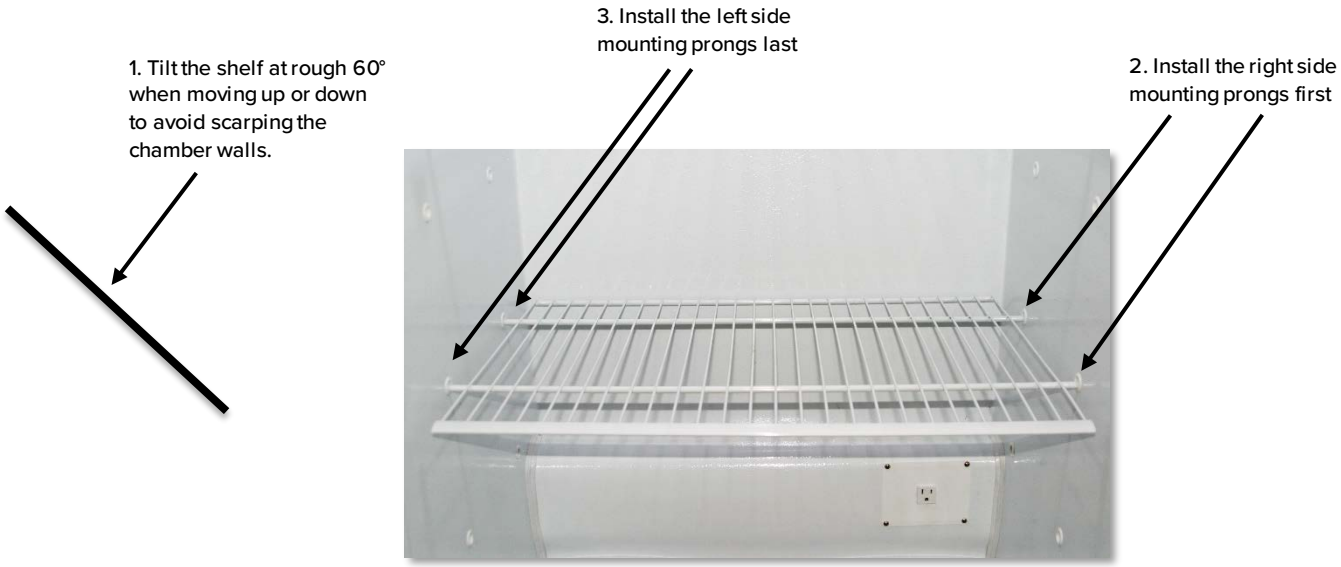


Figure 2: Shelf Installed

Deionized and Distilled Water

Do not use deionized water to clean the chamber. 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 applications.

Installation Cleaning and Disinfection

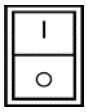
If required by your laboratory protocol, clean and disinfect the unit chamber and shelving components prior to installation. Cleaning and disinfecting reduce the risk of contamination. The chamber and shelving were cleaned and disinfected at the factory, however, Sheldon Manufacturing cannot guarantee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

Remove all protective wrappings from shelving components prior to cleaning.

Please see the **Cleaning and Disinfection procedure** on page 27 of the User Maintenance section for information on how to clean and disinfect without damaging the unit and its components.

GRAPHIC SYMBOLS

The unit is provided with graphic symbols on its interior and exterior surfaces. These symbols identify hazards, as well as the functions of the adjustable components, and important notes in the user manual.

Symbol	Definition
	Consult the user manual. Consulter le manuel d'utilisation
	Temperature display Indique l'affichage de la température
	Over Temperature Limit system Thermostat température limite contrôle haute
	Manually adjustable Indique un réglage manuel
	AC Power Repère le courant alternatif
	I/ON O/OFF I indique que l'interrupteur est en position marche. O indique que le commutateur est en position d'arrêt.
	Protective earth ground Terre électrique
	Adjusts UP and DOWN Réglable vers le haut et vers le bas
	Potential Shock Hazard Risque de choc électrique
	Recycle the unit. Do not dispose of in a landfill. Reycle l'unité. Ne jetez pas dans une décharge

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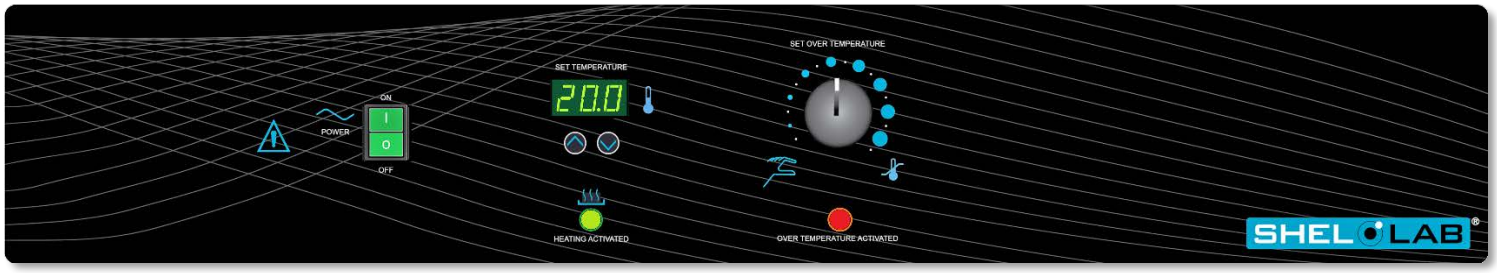
CONTROL PANEL OVERVIEW



Power Switch

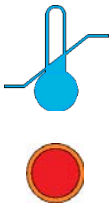
The power switch controls all power to the unit and its systems. Power is supplied when the switch is illuminated and in the (I) on position.

Incubator Temperature Display

During normal operations, the display shows the current incubator air temperature, accurate to 0.1°C. The Up and Down buttons are used to change display modes and then input either a new temperature set point or a calibration adjustment. The display blinks continually while in its set point or calibration adjustment modes, preceded by an “SP” for Set Point or “C O” for calibration offset.

The Heating indicator light illuminates when power is routed to the incubator heating element. During normal operations, the green light will flicker on and off almost continually.

Over Temperature Limit



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 21).

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THEORY OF OPERATION

These refrigerated incubators are engineered to provide constant temperature incubation environments suitable for BOD applications. Each unit can obtain a stable, uniform temperature in its chamber, ranging from 0°C up to 40°C.

Achieving and Maintaining the Temperature Set Point

When the SRI20 is powered, its refrigeration compressor runs continuously. The chamber temperature controller is wired to a solid-state temperature probe located in the chamber airstream on the chamber back wall. When the controller detects that the chamber temperature has dropped below the set point, it pulses power to a heating element. The element is located adjacent to the compressor chiller coil in an air recirculation duct at the bottom of the unit.

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.

A circulation fan provides even air distribution throughout the chamber and plays an important role in maintaining temperature uniformity around the shelf space.

Temperature Low Limit Cutoff

The refrigeration system comes with a cut off limit set at 1°C. This helps prevent the chamber temperature from dropping below freezing and endangering samples and fluid-filled sample containers.

The Over Temperature Limit System (OTL)

The OTL is a backup mechanical heating control system that operates independently of the microprocessor controller. When set, the OTL prevents runaway heating in the event of a failure of the main temperature control system or an external heat spike by rerouting power away from the heating element.

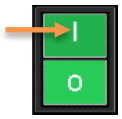
The system consists of a mechanical thermostat control wired by a fluid capillary to an independent hydrostatic temperature probe located on the back wall of the incubation chamber. The OTL is set **by the end-user** at approximately 1°C above the current chamber temperature when operating stabilized at your application temperature.

Because of its nature as a 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 samples can be transferred to another incubator and the first unit repaired.

PUT THE INCUBATOR INTO OPERATION

Putting the incubator into operation new workspace environment requires an **8-hour period** for the unit to come up to and stabilize at temperature prior to loading the incubation chamber with samples. During this period the incubator must be powered continually with the chamber door closed. Allowing time for stabilization helps protect samples. It is also necessary for the optional temperature display accuracy verification procedures, as well as any resulting calibration.

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



1. Plug the power cord into the workspace supply outlet
2. Place the Power switch in the on (I) position
3. Perform the following Operation procedures in order:

Optional: Set the Temperature Set Point, page 23.

- The incubator comes from the factory set to 20°C.

Optional: If you are required by your laboratory protocol to verify the accuracy of the incubator temperator display, set up your verification equipment and test probes now. Please see the Suggested Calibration procedure, starting on page 32.


Wait 8 Hours

Required: Allow the incubator to thermally stabalize by operating sealed and undisturbed for 8 hours before continuing.

Set the Over Temperature Limit, page 24

Load the Chamber, page 25

End of procedure

SET THE TEMPERATURE SET POINT

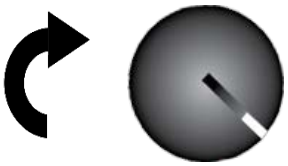
The incubator comes from the factory with a set point of 20°C. Perform the steps below to change the set point to your process or application temperature.

Set Temperature Set Point

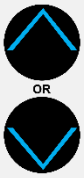
1

Turn the **OTL** dial clockwise to its max setting, if not already set at max.

- This prevents the heating cutoff system from interfering with this procedure.



2



Briefly push and release either of the temperature arrow buttons to activate the temperature set point adjustment mode.

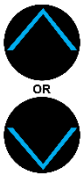
- The display will briefly flash the letters “SP”, then show the flashing, adjustable temperature set point.

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

3



Adjust the set point to your application temperature using the **Up** or the **Down arrow keys**.

New Set Point

4

Wait 5 seconds after entering the set point.

- The display will stop flashing, and the set point is now saved in the controller.
- The chamber will now automatically heat cool to match your set point.
- The display will revert to showing the current chamber air temperature.

Heating to New Set Point

5

See the **Set the OTL procedure** on page 24 for how to set the OTL system once the incubation chamber has stabilized at your application temperature set point and after you have performed any display verifications or calibrations.

Note: When putting the unit into operation in a new location, allow the incubator to run 8 hours prior to setting the OTL.

End of Procedure

SHEL LAB®

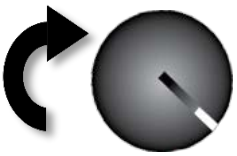
Note: Test the OTL system at least once per year for functionality.

SET THE OVER TEMPERATURE LIMIT

The incubator must be operating at your incubation application temperature and must be stable for at least 1 hour prior to setting the OTL. Allow the unit to operate for at least 8 hours prior to setting the OTL when first placing it into operation.

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.

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.

4

Leave the OTL dial set slightly above the activation point.

- The Over Temperature Limit is now set approximately 1°C above the current incubator temperature.

If the OTL is sporadically activating, you may turn the dial very slightly to the right (clockwise).

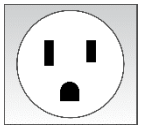
If the OTL continues activating, check for ambient sources of heat or cold that may be adversely impacting the unit temperature stability. Check if any powered accessories in the incubation chamber are generating heat. If you find no sources of external or internal temperature fluctuations, contact Tech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

End of procedure

LOADING SAMPLES

The manufacturer strongly recommends waiting at least 8 hours after putting the incubator in operation before loading samples in the chamber. This safeguards samples against temperature instability. The samples should by placed at least 1 inch (2.5cm) away from the chamber walls. Proper spacing allows for maximum air circulation and a higher degree of temperature uniformity.

ACCESSORY COMPATIBILITY AND POWER OUTLET



The SRI20 is provided with a 110 - 120 voltage, 1 amp power outlet inside the chamber. Do not attach powered equipment that draws more than 1 amp.

Verify that any powered accessory equipment used inside the chamber can safely and effectively operate within your selected temperature range. Powered equipment, such as stirrers or shakers, can generate heat sufficient to disrupt the thermal uniformity and stability of the chamber.

CONDENSATION AND THE DEW POINT

Relative humidity inside the incubation chamber should never be allowed to exceed 80% at 25°C. 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 incubation 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 incubation 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.

- 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 gasket for damage, wear, or signs of brittleness or dryness. Arrange for replacement of the gasket 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 tout entretien ou nettoyage de cet appareil, débranchez le cordon d'alimentation de l'alimentation.

CLEANING AND DISINFECTING

If a **hazardous material or substance** has spilled in the unit, immediately initiate your site 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 cleaners or disinfectants that contain solvents capable of harming paint coatings, acrylic glass, or stainless steel surfaces. **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.

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

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

Cleaning

1. Remove all removable accessories (shelves, racks, and any additional items) from the incubation chamber.
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

Keep the following points in mind when carrying out your laboratory, clinical, or production space disinfection protocol:

- Turn off the unit to safeguard against electrical shocks.
- Disinfect the unit using commercially available disinfectants that are non-corrosive, non-abrasive, and suitable for use on plastic and painted surfaces. Contact your local Site Safety Officer for detailed information on the disinfectants compatible with your incubation or culturing applications.
- Do not use overtly volatile disinfecting agents. Chlorines, amphyls, and quaternary ammonias will evaporate into the chamber environment. Concentration in the chamber atmosphere will increase over time, potentially leading to inhibited growth or metabolic symptoms in sample populations.
- If possible, remove all interior accessories (shelves, Petri dish racks, and other non-attached items) from the chamber when disinfecting.
- Disinfect all corners of the chamber.
- After completion of your institutional protocol, allow all disinfectants to evaporate completely.

MINIMIZING CONTAMINATION EXPOSURE

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

- Maintain a high air quality in the laboratory workspaces around the chamber.
- Avoid placing the unit near sources of air movement such as doors, air vents, or high traffic routes in the workspace.
- Minimize the number of times the chamber door is opened during normal operations.
- Periodically, inspect the door latch, trim, catch, and gaskets for signs of deterioration.

ELECTRICAL COMPONENTS

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

REFRIGERATION AND DEFROSTING

The refrigeration compressors of most home refrigerators run periodically in order to maintain an average chamber temperature centered on the thermostat setting. This results in temperature oscillations of up to 2° or 3°C and reflects the fact that affordable refrigeration compressors cannot provide the high degree of temperature stability needed for laboratory applications — at least not without assistance.

To counteract this instability, refrigeration compressors in the SRI family of incubators and plant growth chambers run continually to provide constant chilling. At the same time, precise applications of heat maintain thermal stability in the incubation or cultivation chamber to approximately ±0.5°C.

Freezing and Defrosting

Air is chilled in the chamber by blowing over a refrigeration coil. The surface temperature of the coil may dip below freezing. This happens frequently when the unit is run toward the cold end of its performance range. At these temperatures, humidity in the air will condense and freeze on the coil.

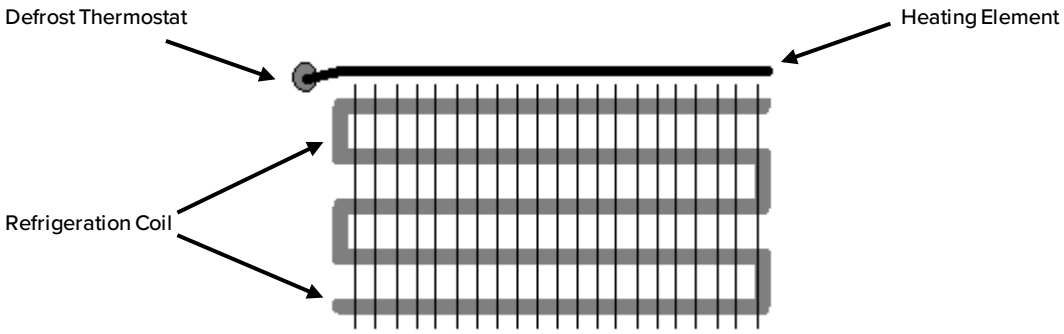


Figure 3: Refrigeration Coil and Heating Element

To counteract this, a defrost thermostat that checks the temperature of the coils for 20 minutes, once every 12 hours. If the coil surface temperature is cool enough for ice to form during the 20-minute interval, the defrost thermostat deactivates the compressor. This allows heat from the nearby heating element to melt the ice on the coil without having to compete with the chilling flow of coolant fluid through the coil. The defrost thermostat reactivates the compressor when the surface temperature rises above the defrost trigger set point or when the 20-minute interval comes to an end.

If the incubator is running at the low end of its temperature range, defrosting can result in short-lived but significant heat spikes in the unit incubator. This may preclude its use in biological oxygen demand studies below 20°C.

Factors in Ice Build Up

Incubators and diurnal chambers used for biologic oxygen demand studies and other closed-container applications will generally require infrequent and very short defrost runtimes. However, runtimes may be prolonged and occur more frequently if the incubator is used in a high humidity environment with the door opened several times a day or left open for prolonged periods. Units with open media containers, water pans, and other sources of evaporating water in the incubation chamber may also experience significant ice buildup. This will necessitate long runs of the auto defrost cycle twice a day. If the humidity is high enough and the temperature is set toward the low end of the unit performance range, humidity can overwhelm the defrosting cycle, and significant ice accumulation may occur on the coil.

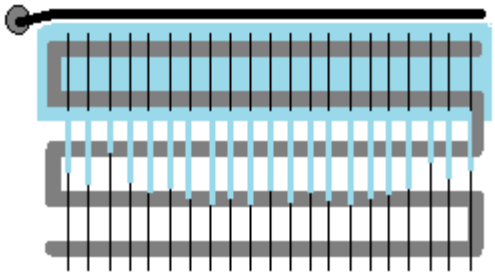


Figure 4: Ice on the Cooling Coil

Loss of Efficiency

As ice accumulates, it insulates the heat-transporting coolant fluid within the coil, driving an increasing loss of chilling efficiency. This may even cause false high temperature readings on the defrost thermostat and prevent the system from recognizing that a defrost run is needed. When this occurs, the first sign of trouble is often a rise in the chamber temperature, even though the main control temperature set point has not been changed.

Units with heavy accumulations of ice on the cooling coil must be manually defrosted by shutting down the unit for a 24-hour period. This provides sufficient time for the ice to melt. See the next page for manually defrosting the chamber.

Forcing the Defrost Cycle

For units that are icing up from high humidity and low temperature settings, Sheldon Manufacturing offers a defrosting system retrofit kit that replaces the defrost thermostat installed at the factory. The retrofit kit automatically turns off the compressor for ten minutes every twelve hours, regardless of the temperature on the coil surface. Please see the SHEL LAB website for pricing or contact Sheldon Technical Support if you have any questions. Part Number 9900577.

Turning Off the Automatic Defrost

Deactivating the defrost thermostat will result in ice accumulation and a gradual loss of cooling efficiency. Incubators used for BOD and other closed-container applications with the defrost thermostat turned off will likely require manual defrosting every 6 months. Units with open sources of water evaporation and the defrost thermostat shut off will require manual defrosting every 2 to 3 months. The exact interval depends on the environmental humidity, temperature setting, and the amount of evaporation taking place inside the incubation chamber.

Figure 5: Defrost Cycle Switch – Top Left of Unit, Back side

Manual Defrosting

Carryout the following steps to manually defrost the SRI20:

1. Unplug the incubator, open the chamber door, and allow the unit to stand undisturbed with the door open for 24 hours.
2. Wipe up any condensate that forms in the chamber as well as any water around the incubator after 24 hours have elapsed.
3. Close the chamber door, plug the incubator power cord into the wall power source, and place the unit back into operation.

The Low Set Limit Dial (Avoiding Freezing Temps)

The SRI20 comes with a low set limit system control, set at the factory to turn off the refrigeration compressor when the incubator air temperature falls to just above 0°C. This is intended to prevent the incubator from reaching or falling below the freezing point. Freezing and sub-freezing temperatures risk damaging plant samples and as well as fluid-filled BOD sample containers.

Under most circumstances, the low set limit system should not be adjusted. If you wish to adjust the limit setting, please contact **Technical Support** (page **Error! Bookmark not defined.**). **The manufacturing defect warranty does not cover damage** to the unit or samples by freezing or subfreezing temperatures if the low set limit has been set to 0°C or lower than 0°C. The unit is not intended to be operated at freezing or sub-freezing temperatures.

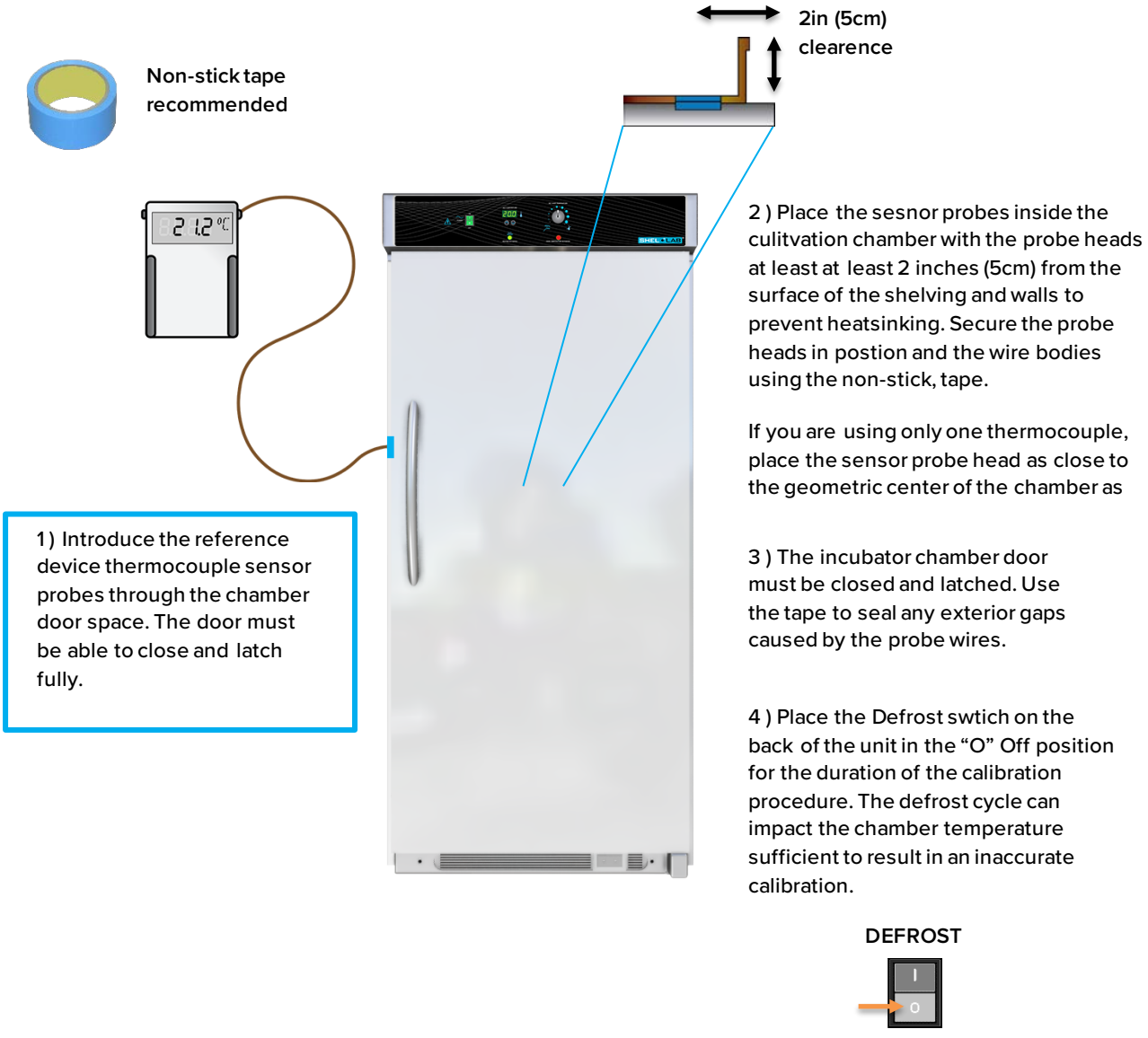
Figure 6: Low Set Limit Dial (Bottom Left of Unit, Back)

CALIBRATE THE TEMPERATURE DISPLAY

Note: Performing a temperature display calibration requires a temperature reference device. Please see the Reference Sensor Devices entry on page 9 for device requirements.

Temperature calibrations are performed to match the incubator temperature display to the actual air temperature in the incubation chamber. The actual air temperature is supplied by a calibrated reference device. Calibrations compensate for long-term drifts in the microprocessor controller as well as those caused by the natural material evolution of the sensor probe in the heated and chilled incubation space. Calibrate as often as required by your laboratory or production protocol, or regulatory compliance schedule. Always calibrate to the standards and use the calibration setup required by your industry requirements or laboratory protocol.

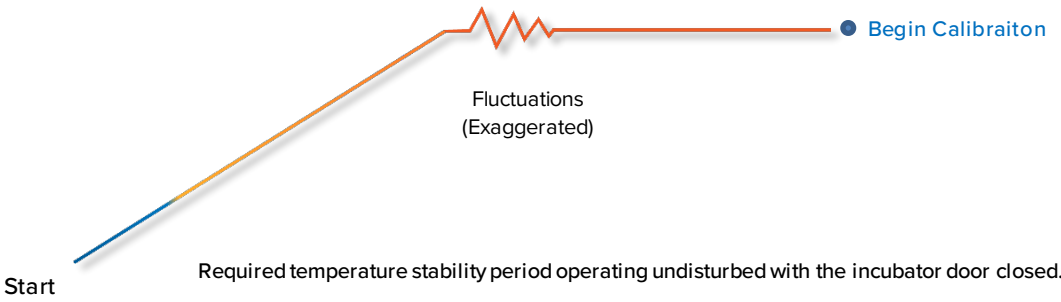
Suggested Single Point Offset Calibration Setup



Temperature Stabilization

The incubator air temperature must stabilize in order to perform an accurate calibration.

- Allow the incubator to operate undisturbed with the door shut for **at least 8 hours** when first putting the unit into operation in a new environment.
- To be considered stabilized, the incubator chamber must operate at your calibration temperature for **at least 1 hour with no fluctuations of ±0.5°C or greater.**



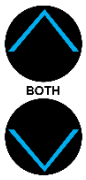
	Suggested Temperature Calibration	
1	Once the incubator temperature has stabilized, compare the reference device and incubator temperature display readings. • If the readings are the same, or the difference between the two falls within the acceptable range of your protocol, the display is accurately showing the chamber air temperature. **The Temperature Calibration procedure is now complete.** **-Or-** • If a difference falls outside of your protocol range, advance to step 2.	Reference Device 
2	A display calibration adjustment must be entered to match the display to the reference device. See next step.	**Reference Device**  

Continued on next page

Temperature Calibration Continued

3

Place the display in its temperature calibration mode.



a. Press and hold both the **UP** and **DOWN** temperature buttons simultaneously for approximately 5 seconds.

b. Release the buttons when the temperature display shows the letters “C O”. 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 number as the new current chamber temperature value.

4

Use the **Up** and **Down** buttons to adjust the current display temperature value until it matches the reference device temperature reading.

Reference Device

5

After matching the display to the reference device, wait 5 seconds.

- The temperature display will cease flashing and store the corrected chamber display value.
- The incubator will now begin heating or cooling in order to reach the set point with the corrected display value.

Cooling to Set Point

6

Allow the incubator sit for at least one 1 hour undisturbed to stabilize **after the incubator has achieved the corrected temperature set point.**

- Failure to wait until the incubator is fully stabilized will result in an inaccurate reading.

Set Point Achieved

Continued on next page

	Temperature Calibration Continued	

7

Compare the reference device reading with the chamber temperature display again.

Reference Device

- 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.**

-Or-

- See the next step if the readings fail to match or fall outside of your protocol range.

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.

Reference Device

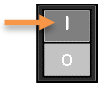
- Three calibration attempts may be required to successfully calibrate units that are more than ±2°C out of calibration.

9

If the temperature readings of the incubator temperature display and the reference device still fall outside your protocol after three calibration attempts, contact your distributor or technical support for assistance.

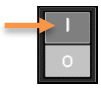
The manufacturer recommends turning the Defrost cycle back on after completing the calibration.

DEFROST



The manufacturer recommends turning the Defrost cycle back on after completing the calibration.

DEFROST



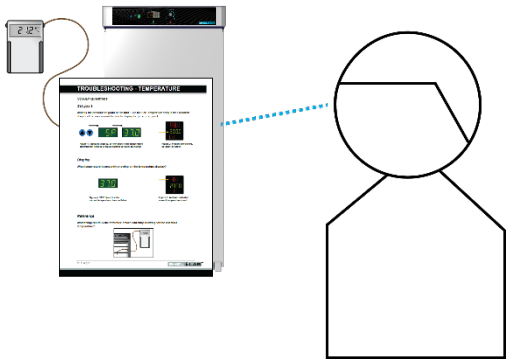
End of procedure

DIAGNOSTICS - TEMPERATURE ISSUES

If the unit is experiencing temperature issues, use the following guide to gather information on the unit, prior to contacting Technical Support. Gathering and sharing this information with Tech Support significantly increases the chance a service technician will be dispatched with the parts needed to fix your unit during their first visit.

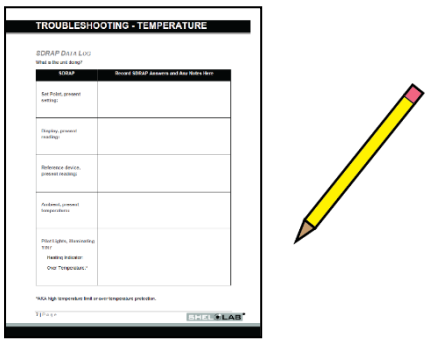
Steps

1



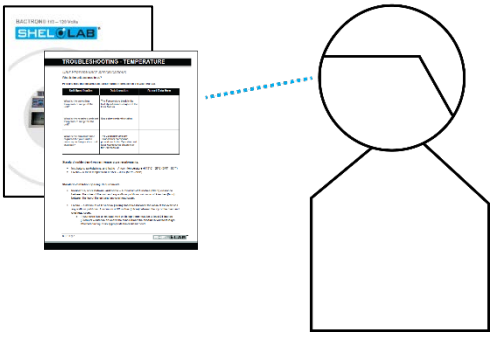
Read the SDRAP diagnostic questions on pages 41 and 42 and observe the unit in operation.

2



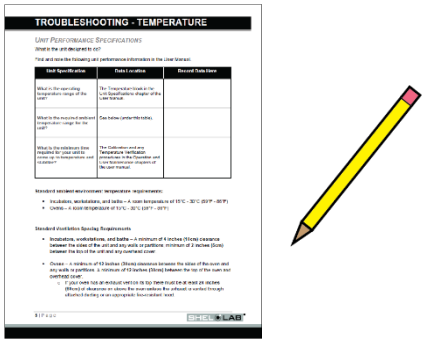
Record the observations in the SDRAP Data Log on page 37.

3



Read the Unit Performance Specification questions on page 38 and consult the user manual for answers.

4



Record the answers in the Unit Specifications Log on page 38.

5 **Share this information with Tech Support!**

SDRAP Data Log

What is the unit doing? See pages 41 - 42 for the detailed walkthrough of the SDRAP questions.

SDRAP	Record SDRAP Answers and Any Notes Here
Set Point, present setting:	
Display, present Temperature reading:	
Reference device, present reading:	
Ambient, present temperature:	
Pilot Lights, illuminating Y/N?	Heating Indicator:
	Refrigeration compressor running, yes / no?
	Over Temperature Activated:

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Unit Performance Specifications

What is the unit designed to do?

Find and note the following unit designation and performance information in the user manual.

Unit Specification	Data Location	Record Data Here
Model Type:	The unit data plate lists the model type. Verify you are attempting to diagnose an SRI20.	
What is the operating temperature range of the unit?	The Temperature block in the Unit Specifications chapter, page 46.	
What is the required ambient temperature range for the unit?	See below (under this table).	
What is the minimum time required for your unit to come up to temperature and stabilize?	Allow a minimum of 4 hours of continual operation for the unit to achieve a stable temperature.	

Standard ambient environment temperature requirements:

- A room temperature of 15°C - 30°C (59°F - 86°F)

Standard Ventilation Spacing Requirements

- A minimum of 4 inches (10cm) clearance between the sides of the incubation chamber and any walls or partitions. A minimum of 2.5 inches (6cm) between the top of the unit and overhead cover.

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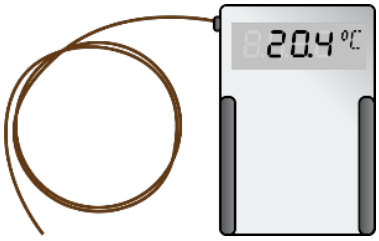
Required Items

You must have the following items on hand to answer the diagnostic questions.

A temperature reference device – A calibrated digital thermometer with sensor probes. The device must be at least as accurate as the temperature display of your unit.

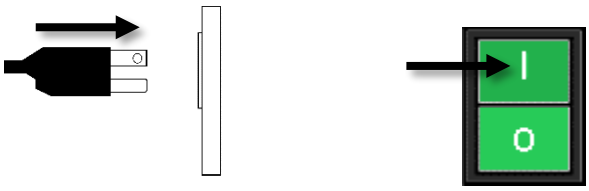


A copy of the user manual for the unit – Must be available in the same room as the unit for use.

Note: Does the car actually have gas in the tank? Have you physically verified the computer is plugged in? Yes, we are going ask some very basic questions. Please bear with. Methodical verifications and the elimination of assumptions are often the quickest means of getting a unit back into operation.

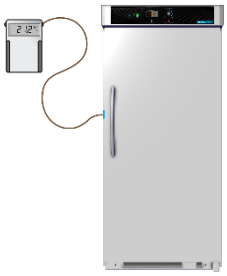
Before Starting

1. The unit must be Connected to a power source that meets the requirements in the Installation chapter (page 13) and turned on.



2. A reference temperature device sensor probe must be placed in the chamber.

   - See the probe placement instructions in the suggested Temperature Calibration procedure on page 32.



3. The unit must have adequate time to come up to temperature and stabilize. **Failure to wait will result in an inaccurate diagnosis.**

- Allow 4 hours for the unit to achieve its temperature.
- Start the "Diagnostic Data Procedure" **when the allotted time has passed**, even if the unit fails to achieve the set point temperature.

Diagnostic Data Procedure – SDRAP Questions

Set point?

What is the present set point of the unit? See the Set Temperature entry in the "Operation" chapter of the user manual for how to display the present set point.

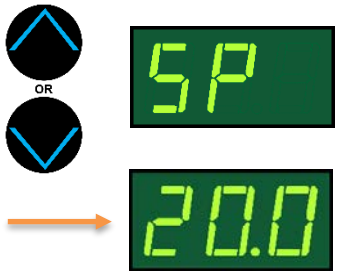


Figure 7: Set Point blinks

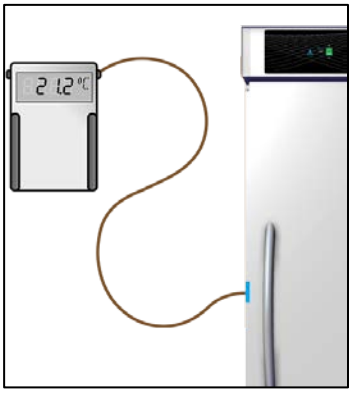
Display?

What temperature is presently showing in the incubator temperature display?

Figure 8: Present temperature, on solid

Reference?

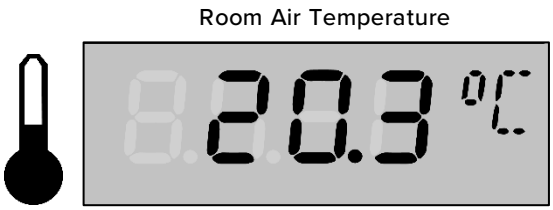
What temperature is the reference device currently showing for the incubator temperature?



Ambient?

What is the room temperature?

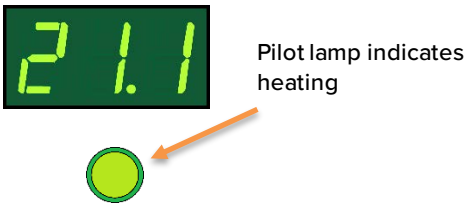
- For best results, measure the temperature in the same section of the room where the unit is located. Do not place your thermometer on the unit.



Pilot Lights?

1) Is the heating active indicator on the control panel flashing or otherwise illuminating.

Figure 9: Heating Indicator



During normal operations, the Heating Activated pilot lot should flicker on and off frequently as the heating element competes with the refrigeration compressor to achieve a stable temperature within ±0.5°C. The compressor should run continually when the unit is on.

Refrigeration: Please listen to hear if the refrigeration compressor is running or not. Note the absence of compressor noises on the SDRAP form. The operation of the compressor in a noisy environment can also be detected from feeling for vibrations on the lower back of the unit.

Cooling issues can also be generated by a failure of the blower fan in the incubation chamber.

2) Is the Over Temperature Limit Activated indicator illuminating? Answer yes if the light is on continually or if it is pulsing.

OVER TEMPERATURE ACTIVATED

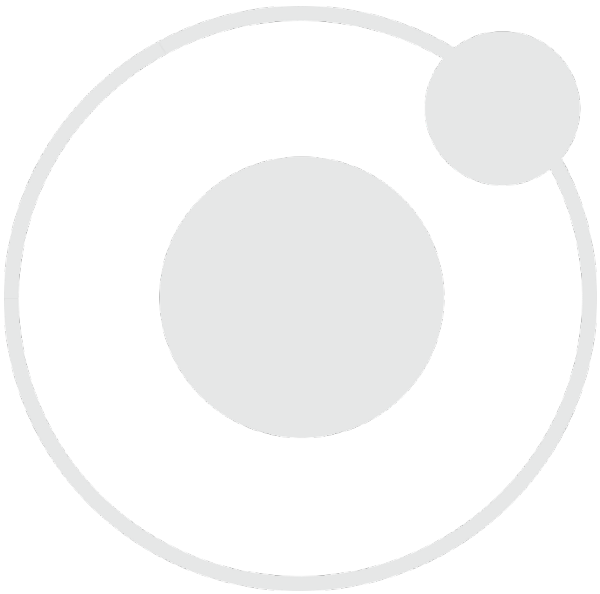
Share!

Share the SDRAP and Unit Specifications data with Technical Support. This data is crucial for offsite personnel making accurate remote diagnoses. The information is used to help ensure service techs are dispatched with the tools and parts needed to fix your unit during the first visit.

Facilities Technicians

SDRAP and Unit Specifications data are also useful to any institutional repair technicians at your facility who may be responsible for servicing of out-of-warranty units.

End Diagnostic Data Procedure



UNIT SPECIFICATIONS

The SRI20 is a 110 - 120 voltage units. **Please refer to the unit 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

Shipping	Net Weight
370 lbs / 168 kg	267.0lbs / 121.0kg

DIMENSIONS

In inches

Exterior W × D × H	Interior W × D × H
36.5 x 34.5 x 79.0 in	27.0 x 23.0 x 56.5 in

In millimeters

Exterior W × D × H	Interior W × D × H
927 x 877 x 2007 mm	686 x 585 x 1435 mm

CAPACITY

Volume

Cubic Feet	Liters
20.3	575.0

Samples

Bottles
305

MAX SHELVES FOR UNIT

Shelves
4

SHELF CAPACITY BY WEIGHT

Per Shelf	Total
20.0lbs / 9.0kg*	80.0lbs / 36.0kg

*20lbs / 9.7kg with the weight evenly distributed across the shelf.

TEMPERATURE

Temp Range	Uniformity	Stability
0° to 45°C	±0.5° @ 20°C	±0.2° @ 20°C

POWER

Model	Voltage	Amperage	Frequency
SRI20	110 - 120	8.0	50/60 Hz

Ordering Parts and Consumables

If you have the Part Number for an item, you may order the item directly from Sheldon Manufacturing by calling 1-800-322-4897 extension 3. If you are uncertain that you have the correct Part Number or if you need that specific part, 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 to its correct part.

SHEL LAB®

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