BOD INCUBATOR

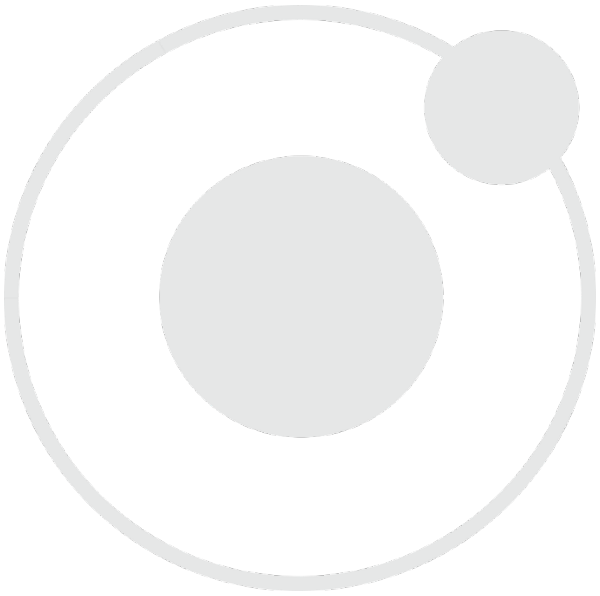
SHEL LAB®

110 – 120 Voltage / 220 – 240 Voltage

Installation - Operation Manual

SRI3 SRI3-2

WARNING: Never use this unit for the growth, cultivation, incubation or storage of **fruit flies** (*drosophila melanogaster*). This unit is not designed for use with **fruit flies**. Improper use of this unit, including use with **fruit flies**, will void any warranty. *Other units are specifically manufactured for **fruit fly** applications, and you should consult your dealer or the manufacturer in order to identify another model suitable for your application.*



BOD INCUBATOR

SRI3 110 – 120 Voltage

SRI3-2 220 – 240 Voltage

Part Number (Manual): 4861574

Revision: February 12, 2018

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

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INTRODUCTION

Thank you for purchasing a SHEL LAB product. 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 for you if you need us.

READ THIS MANUAL

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

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

SAFETY CONSIDERATIONS AND REQUIREMENTS

Follow basic safety precautions, including all national laws, regulations, and local ordinances in your area regarding the use of this unit. If you have any questions about local requirements, please contact the appropriate agencies.

SOPs

Because of the range of potential applications this unit can be used for, the operator or their supervisors must draw up a site-specific standard operating procedure (SOP) covering each application and associated safety guidelines. This SOP must be written and available to all operators in a language they understand.

Intended Applications and Locations

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.

Power

Your unit and its recommended accessories are designed and tested to meet strict safety requirements.

- The unit is designed to connect to a power source using the specific power cord type shipped with the unit.
- Always plug the unit power cord into a protective earth grounded electrical outlet conforming 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.
- Use only approved accessories. Do not modify system components. Any alterations or modifications to your unit not explicitly authorized by the manufacturer can be dangerous and will void your warranty.

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), Monday through Friday. Please have the following information ready when calling or emailing Technical Support: the **model number** and the **serial number** (see page 11).

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

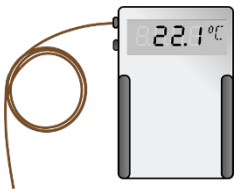
ENGINEERING IMPROVEMENTS

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 customer service representative for assistance.

REFERENCE SENSOR DEVICE

Optional

Must be purchased separately



Temperature Reference

A reference sensor device is required for calibrating the unit temperature display.

Reference devices must meet the following standards:

- Accurate to at least 0.1°C

The device should be regularly calibrated, preferably by a third party.

Temperature Probe

Use a digital device with a wire thermocouple probe that can be introduced into the unit chamber through the door space. Select thermocouples suitable for the application temperature you will be calibrating at.

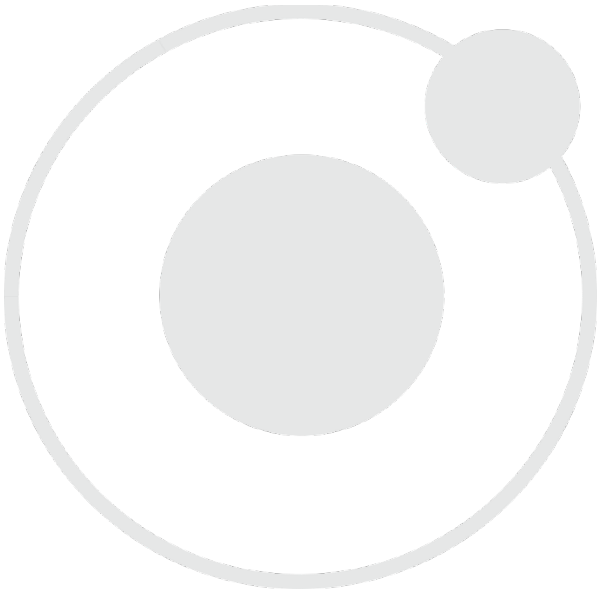
Why Probes?

Reference readings taken outside the chamber using wire temperature probes avoid chamber door openings. Openings disrupt the chamber temperature. Each disruption requires **a minimum 1-hour wait** to allow the atmosphere to re-stabilize before continuing.

No Alcohol or Mercury Thermometers

Alcohol thermometers do not have sufficient accuracy to conduct accurate temperature calibrations. **Never place a mercury thermometer in the unit chamber.** Always use thermocouple probes.

INTRODUCTION



RECEIVING YOUR UNIT

INSPECT THE SHIPMENT

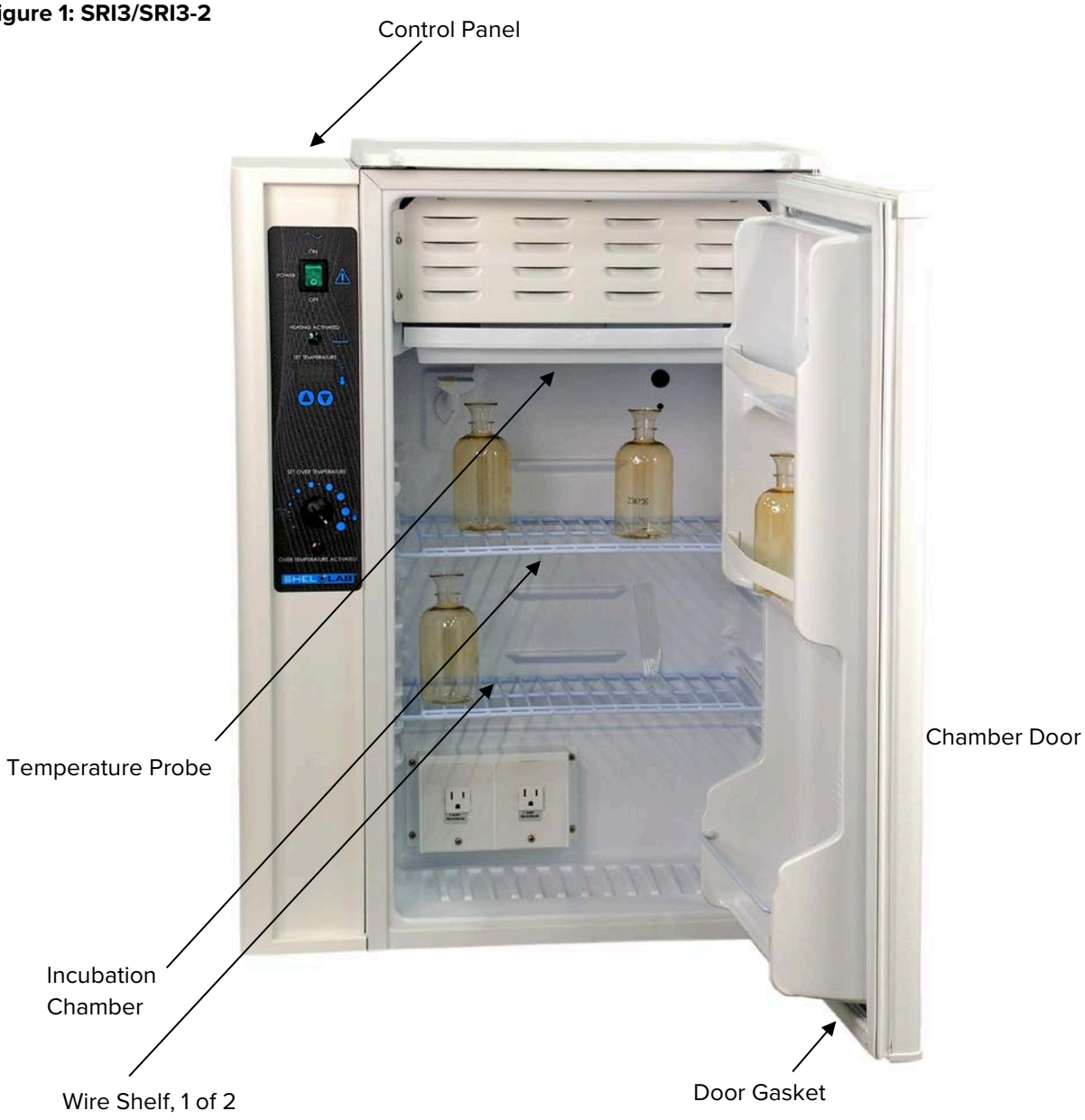
- When a unit leaves the factory, **safe delivery becomes the responsibility of the carrier.**
- **Damage sustained during transit is not covered by the manufacturing defect warranty.**
- Save the shipping carton until you are certain that the unit and its accessories function properly.

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. Inspect the unit for signs of damage. See the orientation depiction on the next page as a reference.
5. The unit should come with an Installation and Operation Manual.
6. Verify that the correct number of accessory items has been included.
7. Carefully check all packaging for accessory items before discarding.

ORIENTATION PHOTO

Figure 1: SRI3/SRI3-2



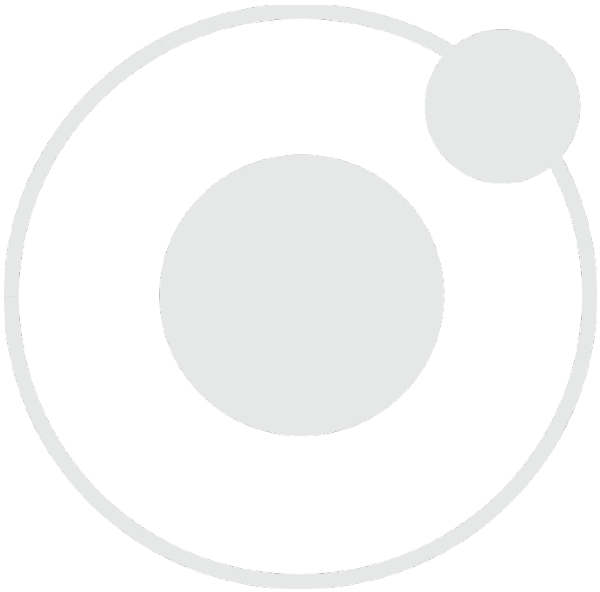
RECORDING DATA PLATE INFORMATION

The data plate contains the unit **model number** and **serial number**. Tech Support will need this information during any support call. Record it below for future reference.

- The data plate is located near the power cord on the back of the unit.

Model Number	
Serial Number	

RECEIVING YOUR UNIT



INSTALLATION CHECKLIST

For installing the unit in a new workspace location.

Pre-Installation

- ✓ Check that the required ambient conditions and ventilation spacing for the incubator are met, page 14.
    - Unit dimensions may be found on page 39.
- ✓ Check that a suitable electrical outlet and power supply is present, page 15.

Install the Incubator in a suitable location

- ✓ Review the lifting and handling instructions, page 16.
- ✓ Install the incubator in its workspace location, page 16.
- ✓ Make sure the incubator is level, page 16.

Set up the Incubator for use

- ✓ Verify that all packaging has been removed from the incubator shelving and incubation chamber. Adjust the shelving positions if need be, page 17.
- ✓ Clean and disinfect the incubator and shelving accessories that will be placed in the incubation chamber, page 17.

Required Ambient Conditions

When selecting a location to install the unit, consider all environmental conditions that can adversely impact its temperature performance. These include:

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

These units are built for use indoors at room temperatures between **15°C and 30°C (59°F and 86°F)**, at no greater than **80% Relative Humidity** (at 25°C / 77°F). Operating outside these conditions may adversely affect the unit temperature performance.

Required Clearances

These clearances are required to provide air flows for ventilation and cooling.

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

4 inches (100 mm) of clearance is required on the sides and back.

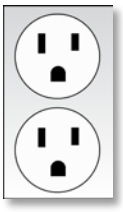
2.5 inches (60 mm) of headspace clearance is required between the top of the unit and any overhead partitions.

POWER SOURCE REQUIREMENTS

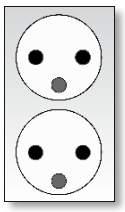
When selecting a location for the unit, verify each of the following requirements is satisfied.

Power Source

The power source for the unit must match the voltage and the amperage requirements listed on the unit data plate. These units are intended for **110 - 120V 50/60 Hz** (SRI3) or **220 – 240V 50/60 Hz** (SRI3-2) applications at the following amperages:



SRI3	SRI3-2
5.0 Amps	3.5 Amps



- **Supplied voltage must not vary more than 10% from the data plate rating**. Damage to the unit may result if the supplied voltage varies more than 10%.
- The wall power source must be protective earth grounded.
- Use a separate circuit to prevent loss of the unit due to overloading or circuit failure.
- The wall power source 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 SRI3 is provided with an integral 120V, 15 Amp, NEMA 5-15P, 8ft (2.5m) power cord.
- The SRI3-2 is provided with an integral 220V, 16 Amp, Euro CEE 7/7, 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 is heavy. Use appropriate lifting devices that are sufficiently rated for these loads. Follow these guidelines when lifting the unit.

- Lift the unit only from its bottom surface.
- Doors, handles, and knobs are not adequate for lifting or stabilization.
- Restrain the unit completely while lifting or transporting so it cannot tip.
- Remove all moving parts, such as shelves and trays, and lock doors in the closed position during transfers to prevent shifting and damage.

LEVELING

The unit must be level and stable for safe operation.

INSTALL INCUBATOR IN LOCATION

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

ADJUST SHELVES

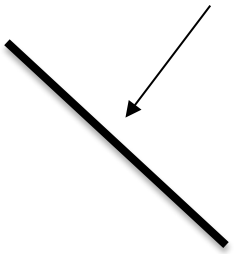
Note: The form factor of the shelves may vary slightly by year of production.

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 materials from the shelving.

Optional: Shelf Adjustment

Move the shelves as needed for your application.



1. Tilt the shelf at roughly 60° up or down when moving to avoid scraping the chamber walls.

2. Install the right side mounting prongs first.

3. Install the left side mounting prongs last.

Figure 2: Shelf Installed

Deionized and Distilled Water

Do not use deionized water to clean the chamber even if it is readily available in your laboratory environment. 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

The manufacturer recommends cleaning the shelving and unit chamber prior to installation of the shelving in the chamber. The unit was cleaned at the factory but may have been exposed to contaminants during shipping. Remove all wrappings and coverings from shelving prior to cleaning and installation. **Do not clean with deionized water.**

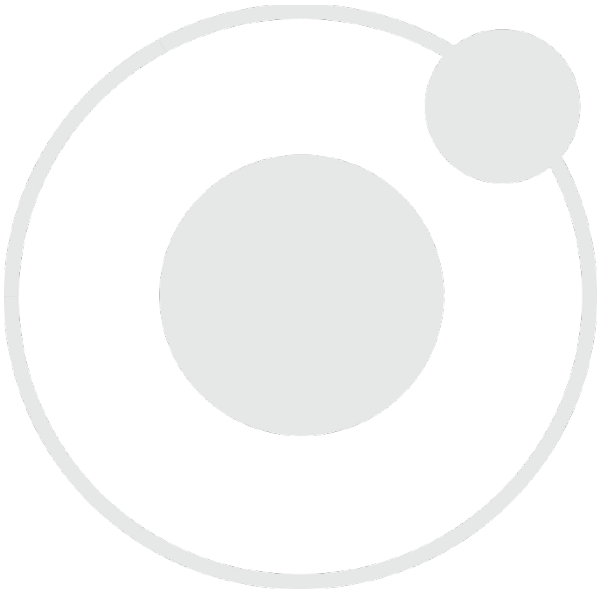
Please see the Cleaning and Disinfection procedure on page 29 of the User Maintenance section for information on how to clean and disinfect without damaging the unit and its components.

GRAPHIC SYMBOLS

Your incubator comes provided with graphic symbols on its exterior surfaces. These identify hazards and the function of the adjustable components, as well as 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
	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 Ajuster le haut et vers le bas
	Manually adjustable Indique un réglage manuel
	Potential shock hazard Risque de choc électrique
	Recycle the unit. Do not dispose of in a landfill. Recycler l'unité. Ne jetez pas dans une décharge

GRAPHIC SYMBOLS



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.

Heating Activated

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.

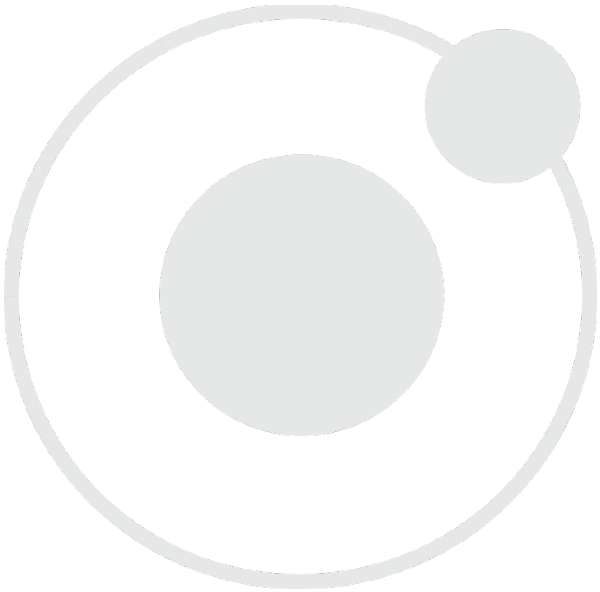
Incubator Temperature Display

The temperature display shows the current incubator air temperature, accurate to 0.1°C. The Up and Down buttons are used to navigate to the temperature set point and calibration adjustment display modes. 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.

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 23).

CONTROL PANEL OVERVIEW



THEORY OF OPERATION

Refrigerated incubators are engineered to provide constant temperature incubation environments suitable for BOD applications. The 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 unit 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 in the chamber.

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.

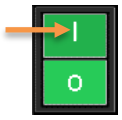
The system consists of a mechanical thermostat control wired by a fluid capillary to an independent hydrostatic temperature probe located on the back wall of the incubation chamber. The OTL is set **by the end-user** at approximately 1°C above the current chamber temperature when operating stabilized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

PUT THE INCUBATOR INTO OPERATION

Putting the incubator into operation in a 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 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 25.

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

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

Set the Over Temperature Limit, page 26

Load the Chamber, page 27

End of procedure

SET THE TEMPERATURE SET POINT

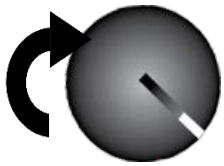
The incubator comes from the factory with a set point of 20°C. Perform the steps below to change the set point to your process or application temperature.

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.

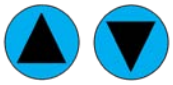
- The display will briefly flash the letters “SP”, then show the flashing, adjustable temperature set point.

Set Point Adjustment Mode

Note: The display will automatically exit the adjustment mode after 5 seconds of inactivity, with the last shown set point value saved.

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 or 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 26 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

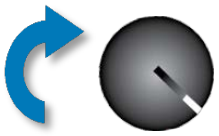
SHEL LAB®

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. Set OTL control to its maximum setting, if not already set to max.



2. Turn the dial counterclockwise until the red Over Temperature Limit Light illuminates.

3. Slowly turn the dial clockwise until the OTL Activated light turns off.

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

4. Leave the OTL dial set just above the activation point.

Optional: Turn the dial slightly to the left.

- This sets the OTL cutoff threshold nearer to the current incubator air 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 **Technical Support** or your distributor for assistance.

End of procedure

LOADING SAMPLES

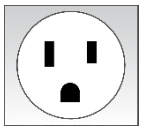
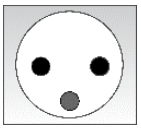
The manufacturer strongly recommends waiting at least 8 hours after putting the incubator in operation before loading samples in the chamber. This safeguards samples against temperature instability. The samples should by placed at least 1 inch (25 mm) away from the chamber walls. Proper spacing allows for maximum air circulation and a higher degree of temperature uniformity.

ACCESSORY COMPATIBILITY AND POWER OUTLET

Outlets

The SRI3 is provided with 2 power outlets inside the chamber. Do not attach powered equipment drawing more than 1 amp from both outlets.

The SRI3-2 is provided with 1 power outlet inside the chamber. Do not attach powered equipment drawing more than 1 amp from the outlet.

SRI3	SRI3-2
110 – 120 Volt	220 – 240 Volt
	

Accessories

Verify 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.

- Ensure 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 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: Disconnect the unit from its power supply prior to performing maintenance or services.

Avertissement: Débranchez cet appareil de son alimentation électrique avant d'effectuer la maintenance ou les services.

CLEANING AND DISINFECTING

If a **hazardous material or substance** has spilled in the unit chamber, 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.
- Do not use spray on cleaners or disinfectants. These can leak through openings and coat electrical components.
- 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 the material contained in it.
- 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: Exercise caution if cleaning the unit with alcohol or flammable cleaners. Always allow the unit to cool down to room temperature prior to cleaning and make sure all cleaning agents have evaporated or otherwise been completely removed prior to putting the unit back into service.

Avertissement: Soyez prudent lorsque vous nettoyez l'appareil avec de l'alcool ou des produits de nettoyage inflammables. Laissez toujours refroidir l'appareil à la température ambiante avant le nettoyage et assurez-vous que tous les produits de nettoyage se sont évaporés ou ont été complètement enlevés avant de remettre l'appareil en service.

Cleaning

1. Disconnect the unit from its power supply.
2. Remove all removable interior components such as shelving and accessories.
3. Clean the unit with a mild soap and water solution, including all corners.
    - **Do not use an abrasive cleaner**, these will damage metal surfaces.
    - **Do not use deionized water to rinse or clean with.**
    - Take special care when cleaning around the temperature sensor probes in the chamber to prevent damage. Do not clean the probes.
4. Rinse with distilled water and wipe dry with a soft cloth.

Disinfecting

For maximum effectiveness, disinfection procedures are typically performed after cleaning. Keep the following points in mind when disinfecting the unit.

- Turn off and disconnect the unit to safeguard against electrical hazards.
- Disinfect the unit chamber using commercially available disinfectants that are non-corrosive, non-abrasive, and suitable for use on stainless steel and glass surfaces. Contact your local Site Safety Officer for detailed information on which disinfectants are compatible with your applications.
- If permitted by your protocol, remove all removable interior accessories (shelving and other non-attached items) from the chamber when disinfecting.
- Disinfect all surfaces in the chamber, making sure to thoroughly disinfect the corners. Exercise care to avoid damaging the sensor probes.
- Gas concentrations from evaporating disinfecting agents can inhibit growth or cause metabolic symptoms in microbiological sample populations. Make sure that chlorines, 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.

When disinfecting external surfaces, use disinfectants that will not damage painted metal, glass, and plastic.

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 6).

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 low end of its performance range. At these temperatures, humidity in the air will condense and freeze on the coil.

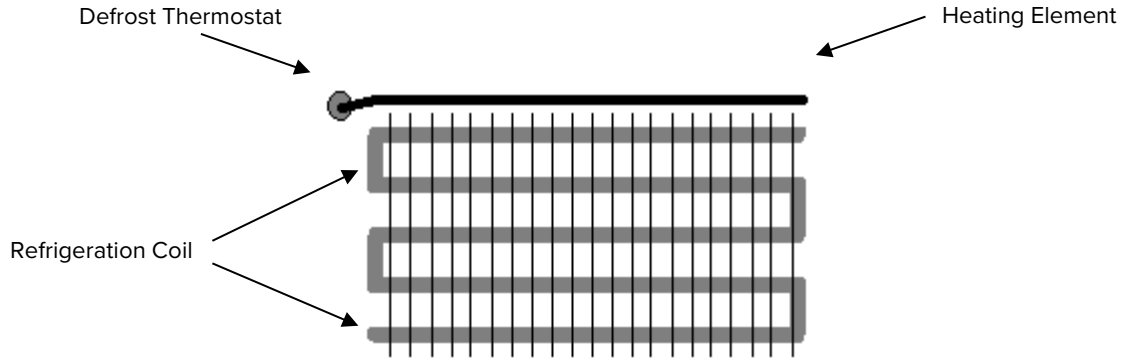


Figure 3: Refrigeration Coil and Heating Element

To counteract this, a defrost thermostat 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 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.

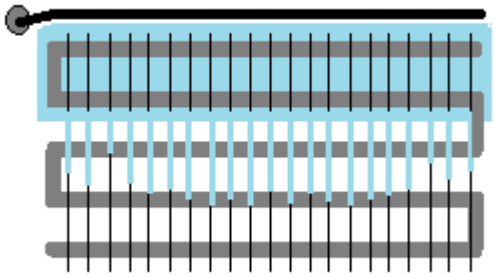


Figure 4: Ice on the Cooling Coil

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, the manufacturer offers a defrosting system retrofit kit that replaces the defrost thermostat installed at the factory. The retrofit kit automatically turns off the compressor for 10 minutes every 12 hours, regardless of the temperature on the coil surface. Please contact your distributor or Technical Support if you have any questions.

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 side on the back of the incubator

Manual Defrosting

Carry out the following steps to manually defrost the unit:

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 Limit Dial (Prevents Freezing Temps)

The unit comes with a Low Limit Control System set at the factory to turn off the refrigeration compressor when the incubator air temperature falls to just above freezing (0°C). Freezing and sub-freezing temperatures risk damaging plant samples as well as fluid-filled BOD sample containers.

If you wish to adjust the limit setting, please contact **Technical Support** (page 6). The unit is not intended to be operated at freezing or sub-freezing temperatures. Setting the low set limit at or below 0°C voids the manufacturing defect warranty.

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 7 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

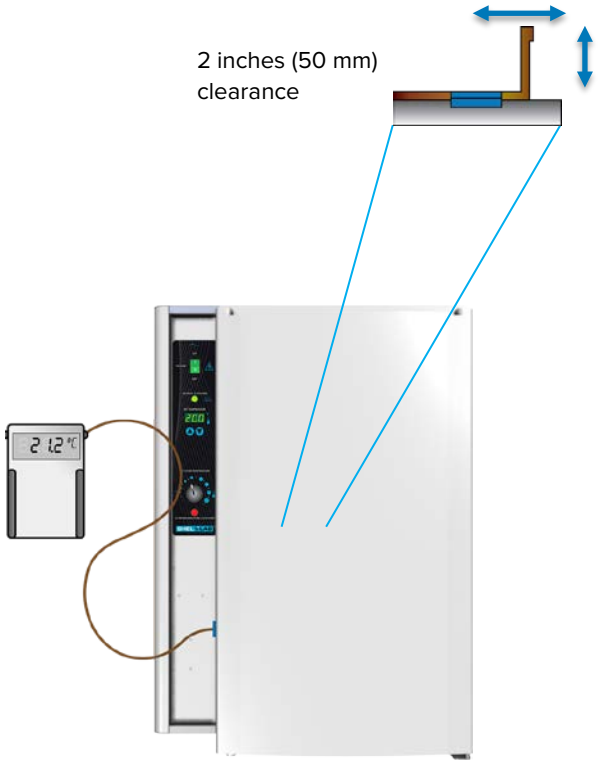
1. Introduce the reference device thermocouple sensor probe through the chamber door space. The door must be able to close and latch fully.

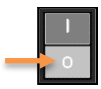
2. Place the probe inside the cultivation chamber with the sensor head as close to the geometric center of the chamber as possible. The probe head must be at least 2 inches (50 mm) from the surface of the shelving and walls to prevent heatsinking. Secure the probe heads in position using the non-stick tape.

3. The incubator chamber door must be closed and latched. Use the tape to seal any exterior gaps caused by the probe wires.

4. Place the Defrost switch on the back of the unit in the “O” Off position for the duration of the calibration procedure. The defrost cycle can impact the chamber temperature sufficiently to result in an inaccurate calibration.

Non-stick tape recommended



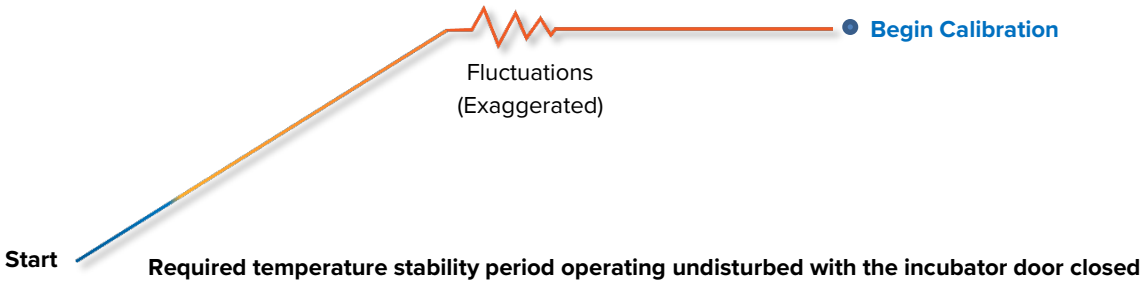


DEFROST

5. 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.

2

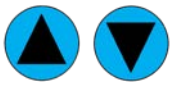
A display calibration adjustment must be entered to match the display to the reference device. See next step.

Continued on next page

Temperature Calibration Continued

3

Place the display in 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 5 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.

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

Wait 1 Hour

Allow the incubator to sit for at least 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.

- 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.

Reference Device

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.

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

Reference Device

9

If the temperature readings of the incubator temperature display and the reference device still fall outside your protocol after 3 calibration attempts, contact your distributor or technical support for assistance.

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

DEFROST

End of procedure

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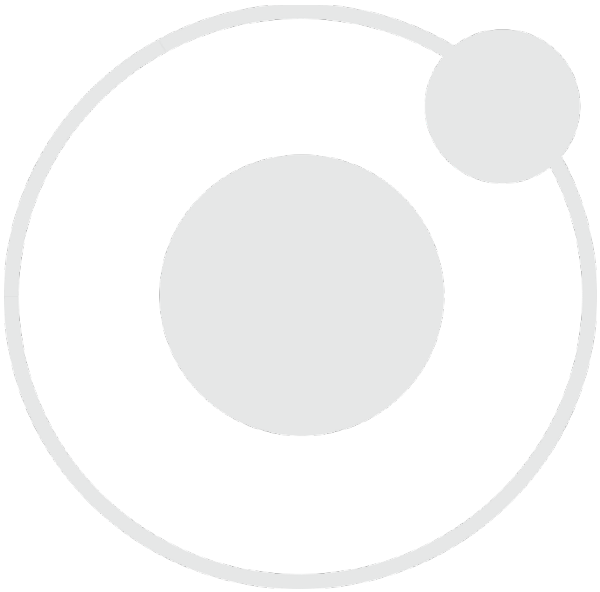

UNIT SPECIFICATIONS

The SRI3 Incubator is a **115 voltage** unit; the SRI3-2 is a **230 voltage** unit. 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 at nominal voltage. 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 Weight
SRI3	110 lb / 50 kg	93.0 lb / 43.0 kg
SRI3-2	125 lb / 57 kg	108.0 lb / 49.0 kg

DIMENSIONS

Inches

Model	Exterior W × D × H	Interior W × D × H
SRI3	24.0 x 21.0 x 33.8 in	16.0 x 14.0 x 22.5 in
SRI3-2	24.0 x 21.0 x 33.8 in	16.0 x 14.0 x 22.5 in

Millimeters

Model	Exterior W × D × H	Interior W × D × H
SRI3	610 x 534 x 858 mm	407 x 356 x 572 mm
SRI3-2	610 x 534 x 858 mm	407 x 356 x 572 mm

CAPACITY

Model	Cubic Feet	Liters
SRI3	2.3	67.0
SRI3-2	2.3	67.0

SHELF CAPACITY BY WEIGHT

Model	Per Shelf	Total
SRI3	10.0 lb / 4.5 kg	20.0 lb / 9.0 kg
SRI3-2	10.0 lb / 4.5 kg	20.0 lb / 9.0 kg

TEMPERATURE

Model	Range	Uniformity	Stability
SRI3	Ambient 0°C to 45°C	± 0.5°	± 0.2°C
SRI3-2	Ambient 0°C to 45°C	± 0.5°	± 0.2°C

POWER

Model	AC Voltage	Amperage	Frequency
SRI3	115	5.0	50/60 Hz
SRI3-2	230	3.5	50/60 Hz

PARTS LIST

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 uncertain 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.

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