11/01

OPERATION MANUAL

MANUAL NO. 057-588-00
REV. P

LAB-LINE®
AUTOMATIC CO_2 INCUBATORS

MODEL NO. **WATER-JACKETED AUTOMATIC CO_2:**

Models With Thermal Conductivity Sensor:
460, 460JPN, 460RH*, 460-1, 460-1CE, 462, 462-1, 462-1CE, 464, 464RH, 464-1, 464-1CE
Models With Infrared Sensor:
465, 465RH*, 465-1, 467, 467-1, 469, 469-1,

AIR-JACKETED AUTOMATIC CO_2:
Models With Thermal Conductivity Sensor:
490, 490RH*, 490-1, 490-1CE, 492, 492-1, 492-1CE, 494, 494-1, 494-1CE
Models With Infrared Sensor:
495, 495JPN, 495RH*, 495-1, 495-1RH, 497, 497-1, 499, 499-1
Models With Thermal Conductivity Sensor And Large Chamber Capacity:
391, 391-1, 391-2**, 391-3**

*With Relative Humidity Display
**With 3-Pen Strip Chart Recorder

DESIGNERS AND MANUFACTURERS
A SUBSIDIARY of Barnstead|Thermolyne
1999 North 15th Ave., Melrose Park, IL 60160-1491 USA
PHONE: (563) 556-2241 or (800) 522-5463; FAX: (563) 589-0516

CE

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SECTION TITLE

BE ADVISED:

IT IS MOST IMPORTANT THAT THE USER FOLLOW INSTALLATION INSTRUCTIONS **EXACTLY AS WRITTEN.** FAILURE TO DO SO IS LIKELY TO LEAD TO IMPROPER OPERATION, ERRONEOUS CALIBRATIONS AND POSSIBLE DAMAGE TO THE EQUIPMENT. **UNDER NO CIRCUMSTANCES** SHOULD THE USER ATTEMPT OPERATION WITHOUT THIS INFORMATION.

THE FOLLOWING EQUIPMENT IS TO BE SUPPLIED BY THE USER:

- Dry CO_2 gas (research grade or better).
- A dual-stage regulator for the CO_2 tank.
- ¼" (6.35mm) ID Flexible tubing (appropriate length from tank to Incubator), and connected per local codes.
- Distilled or deionized water (if humidification is desired).
- Fyrite or similar chemical-based CO_2 analyzer.

BE ADVISED: INSTALLATION AND PRE-OPERATION PROCEDURE WILL TAKE AT LEAST 24 HOURS TO COMPLETE. DO NOT ATTEMPT TO RUSH THE PROCESS WITH SHORT CUTS TO THE PROCEDURES DESCRIBED IN THIS MANUAL.

CERTIFICATION OF DECONTAMINATION:

We cannot accept for service or credit a product that has been exposed to or contaminated with chemically or biologically toxic or infectious substances or subjected to radioactivity without first being certified as free from said contamination.

Please have your Medical and/or Safety Officer sign this form certifying that proper decontamination procedures have been followed to render the product safe and free from hazards.

Any product forwarded to us, not accompanied by this form and a proper Return Goods Authorization Number, will be returned to the sender. To obtain a Return Goods Authorization Number, contact the Customer Relations Department at (800) 522-5463.

We hereby certify that the LAB-LINE INSTRUMENTS, INC. product:

Model No. _____ and Serial No. _____,

that is being forwarded has been properly decontaminated and is free from all toxic hazards, infectious agents, radioactivity and/or other hazards.

Company/Institution Name:

Street Address: _____

City: _____ State_____ Zip_____

Name (please print): _____ Title _____

Signature: _____

Phone: _____

DECONTAMINATION PROCEDURE (Be Specific):

_____

_____

_____

Nature of Hazard That Required Decontamination:

_____

_____

_____

INTRODUCTION

THANK YOU

for selecting Lab-Line Instruments for your equipment needs. For maximum value and ease of start-up,

PLEASE PROCEED AS FOLLOWS:

- Inspect the carton and contents for shipping damage. Notify the carrier immediately if damage is found.
- Use the Accessory Checklist when unpacking to verify that the complete unit has been received. Do not discard packing materials until all is accounted for.
- Read this Operation Manual thoroughly *before* deciding upon an appropriate location for the unit: you will want to consider, where applicable, the availability of power, water, hook-ups, drains and other unit requirements, as well as user convenience.
- Insist that every operator of this unit becomes familiar with the Operation Section of this manual.
- Be sure to fill out the Warranty Registration Card and mail it in to Lab-Line Instruments within seven (7) days after receiving the unit.

IF

after reading this manual you should have any difficulties with the installation or operation instructions, please call:

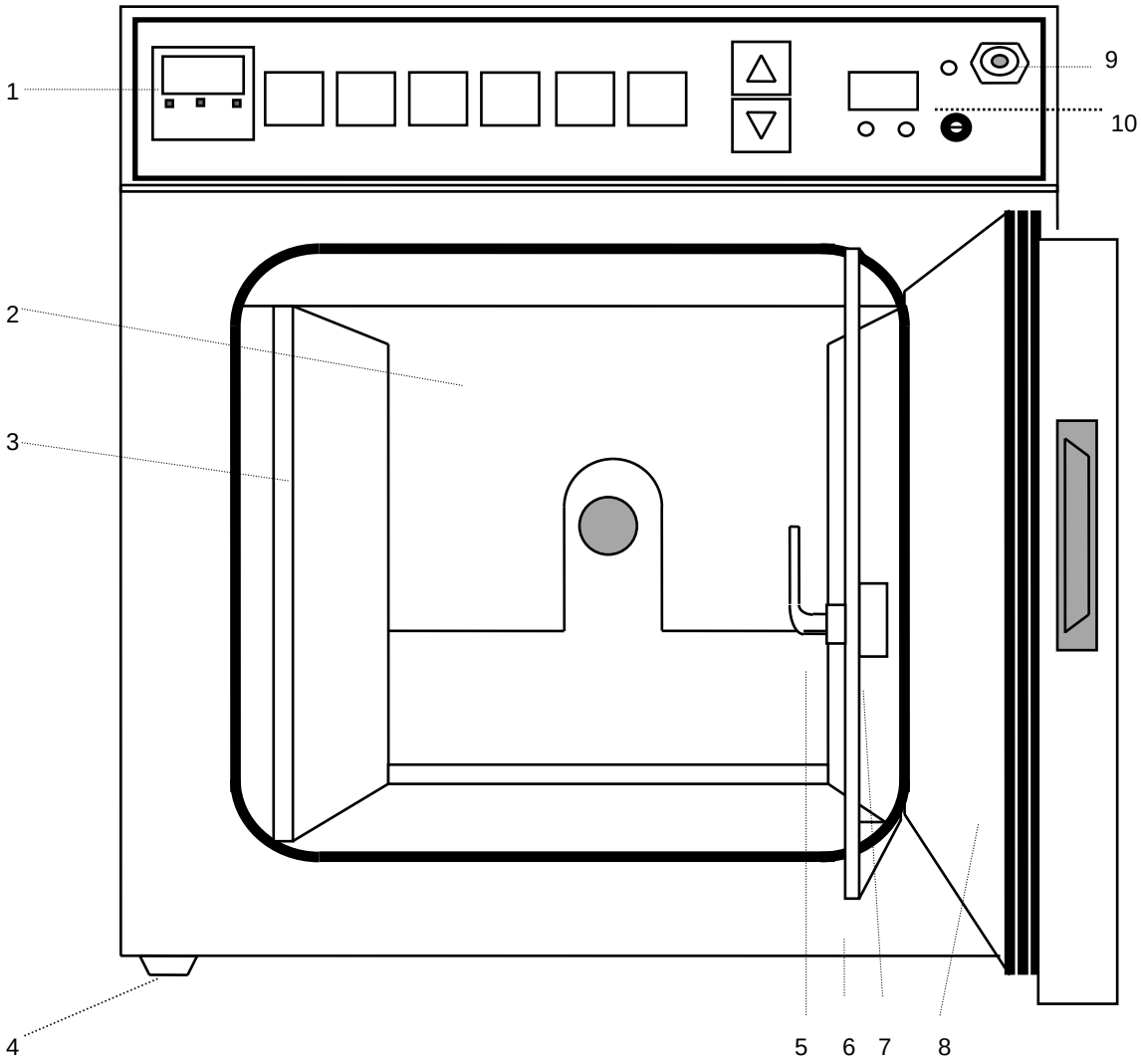
Lab-Line Customer Relations Department
(563) 556-2241 or (800) 522-5463

SECTION 2

DESCRIPTION

BASIC COMPONENTS, AN INITIAL OVERVIEW:

FRONT VIEW:

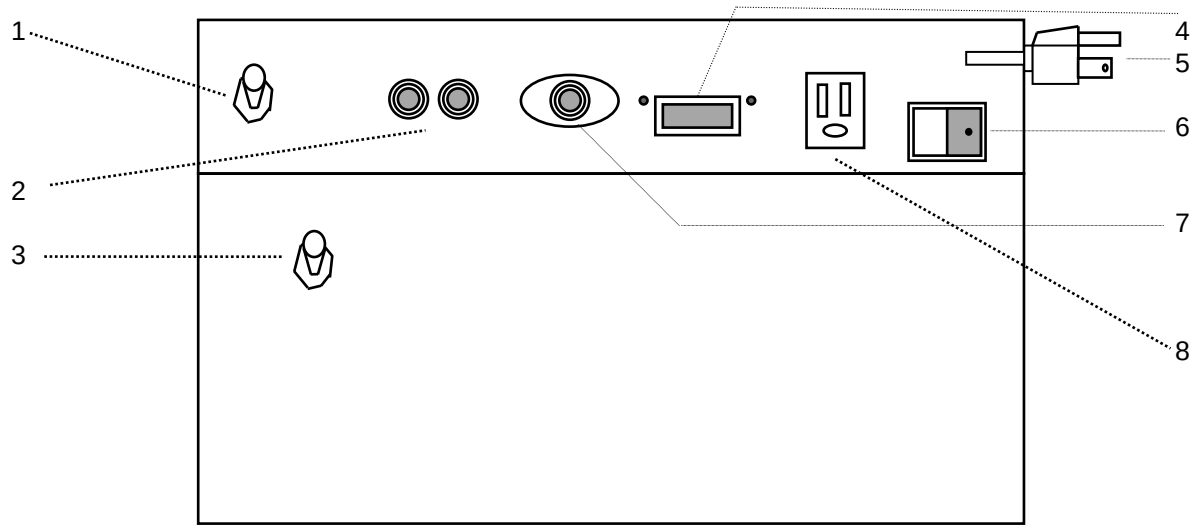


1. CONTROL PANEL
2. REAR WALL COVER
3. SIDE PANEL
4. FEET, LEVELING
5. INNER GLASS DOOR LATCH
6. INNER GLASS DOOR
7. INNER GLASS DOOR, KNOB
8. OUTER STEEL DOOR/GASKET
9. SAMPLE PORT
10. RH DISPLAY; MODELS 460RH, 490RH, 465RH, 495RH 495-1RH ONLY

DESCRIPTION: (Con't)

BASIC COMPONENTS, AN INITIAL OVERVIEW: (CON'T)

REAR VIEW



1. GAS INLET PORT
2. CIRCUIT BREAKERS
3. WATER OVERFLOW OUTLET (460/465 SERIES ONLY)
4. RS232 DATA PINS CONNECTOR
5. CORDSET
6. POWER SWITCH
7. OPTIONAL ALARM RELAY OUTPUT
8. OUTLET (120 VAC UNITS ONLY)

DESCRIPTION: (Con't)

INFRARED CONTROL OF CO_2

This sensor is impervious to relative humidity and is less susceptible to drift and re-calibration. By measuring the absorption of infrared light within a CO_2 atmosphere, the highest level of sensitivity is provided.

THERMAL-CONDUCTIVITY CONTROL OF CO_2:

This sensor measures CO_2 within an atmosphere by the heat of conduction method and provides precise and reliable control.

SYSTEMS AND FEATURES:

All required operating commands are immediately accessible in a functional format on the front of the unit and permit rapid start-up, close monitoring and efficient control of incubation protocols.

Temperature is measured by platinum RTD (resistance temperature detector) producing excellent control within ±0.1ºC. It is combined with the exclusive SmartGas® algorithm method for controlling CO_2 within ±0.1%. The result is a chamber that produces excellent environmental conditions for the most sensitive of incubations.

Air passes downward over the heated area and is then directed upward in a gentle, uniform flow from the chamber floor. This upward draft inhibits the contamination of cultures. If the temperature exceeds the set point by more than the set point setting, power to the heaters is discontinued.

Audible and visual alarms alert the user of any deviation in the chamber of temperature (±1.0°C or better) or carbon dioxide (±1.0°%). In addition, other signals alert the user of such conditions as power failure, door ajar and low water on water jacketed models.

To conserve gas, the CO_2 solenoid valve shuts off automatically any time the insulated, incubator door is opened. The fan motor shuts off during door openings as well.

Required operating commands are immediately accessible in a functional format on the front of the unit and permit rapid start-up, close monitoring and efficient control of the incubation protocols.

To prevent unauthorized access to or alteration of command entries, a password feature may be accessed.

Side-by-side and stacked units are available.

The crevice-free stainless steel interior is designed for easy maintenance and prolongs useful life.

DOUBLE-DOOR CONSTRUCTION WITH INNER DOOR DEFOGGER:

A tempered glass inner door allows observation of chamber contents without disturbing the chamber environment. Inside the steel outer door is a heater that can defog the glass door when necessary. Each door seals to a one-piece silicone gasket for a leak-tight environment.

SECTION 3

SPECIFICATIONS

ELECTRICAL REQUIREMENTS, WATER-JACKETED MODELS:

MODEL	VOLTS	HZ	AMPS	WATTS

460	120	50/60	6.3	750
460JPN*	100	50/60	7.5	750
460-1*	230/240	50/60	3.1	750
462*	120	50/60	12.5	1500
462-1*	230/240	50/60	6.3	1500
464*	120	50/60	12.5	1500
464-1*	230/240	50/60	6.3	1500
465**	120	50/60	6.3	750
465-1**	230/240	50/60	3.1	750
467**	120	50/60	12.5	1500
467-1**	230/240	50/60	6.3	1500
469**	120	50/60	12.5	1500
469-1**	230/240	50/60	6.3	1500

ELECTRICAL REQUIREMENTS, AIR-JACKETED MODELS:

MODEL	VOLTS	HZ	AMPS	WATTS
391	120	50/60	11.3	1350
391-1	230/240	50/60	5.6	1350
391-2***	120	50/60	11.3	1350
391-3***	230/240	50/60	5.6	1350
490*	120	50/60	7.1	850
490-1*	230/240	50/60	3.5	850
492*	120	50/60	14.2	1700
492-1*	230/240	50/60	7.1	1700
494*	120	50/60	14.2	1700
494-1*	230/240	50/60	7.1	1700
495**	120	50/60	7.1	850
495JPN**	100	50/60	8.5	850
495-1**	230/240	50/60	3.5	850
497**	120	50/60	14.2	1700
497-1**	230/240	50/60	7.1	1700
499**	120	50/60	14.2	1700
499-1**	230/240	50/60	7.1	1700

NOTE: UNITS WITH A CE SUFFIX, REFER TO COVER PAGE, ARE CE CERTIFIED AND HAVE THE SAME SPECIFICATIONS AS UNITS WITH A –1 SUFFIX.
NOTE: MODELS WITH RH DISPLAYS HAVE SAME SPECIFICATIONS AS 120VAC UNITS WITHOUT RH DISPLAY.
NOTE: MODELS 492, 492-1, 497, 497-1, 462, 462-1, 467 AND 467-1ARE SIDE-BY-SIDE UNITS.
NOTE: MODELS 494, 494-1, 499, 499-1, 464, 464-1, 469 AND 469-1 ARE STACKED UNITS.
* MODELS WITH THERMAL CONDUCTIVITY CO2 SENSOR.
** MODELS WITH INFRARED CO2 SENSOR.
***MODELS WITH 3-PEN STRIP CHART RECORDER. A SEPARATE RECORDER MANUAL IS PROVIDED WITH THESE UNITS.

SPECIFICATIONS: (Con't)

TEMPERATURE RANGE:
WITH IR SENSOR (465/495 SERIES): Ambient +5ºC to 55ºC
WITH TC SENSOR: Ambient +5ºC to 60ºC

CONTROL: ±0.1ºC

TEMPERATURE UNIFORMITY:	±0.25ºC
ALGORITHM:	TEMPERATURE: PID CO2: SmartGas®
CARBON DIOXIDE TENSION:	Range: 0% to 20% Control: ±0.1%
CAPACITY PER CHAMBER:	
460/490 SERIES:	6.2 cu. ft. (176 l)
391 SERIES:	10.4 cu. ft. (295 l)
SHELVES:	5
CHAMBER DIMENSIONS:	
460/490 SERIES, SINGLE UNIT:	Interior: 22" W x 22" D x 22" H (56 x 56 x 56 cm) Exterior: 24-5/8" W x 25" D x 33" H (63 x 64 x 84 cm)
391 SERIES:	Interior: 30" W x 20" D x 30" H (76 x 51 x 76 cm) Exterior: 32½" W x 25½" D x 45" H (83 x 65 x 114 cm)
SHIPPING WEIGHT:	
460/465 SERIES:	230 lb (104 kg)
490/495 SERIES:	245 lb (111 kg)
462/464, 467/469 SERIES:	460 lb (209 kg)
492/497, 494/499 SERIES:	490 lb (222 (kg)
391 SERIES:	340 lb (154 kg)

UNIT'S ENVIRONMENTAL OPERATING CONDITIONS:

	POLLUTION DEGREE: 2
INSTALLATION CATEGORY:	II
ALTITUDE:	2000 Meters MSL (Mean Sea Level)
HUMIDITY:	80% maximum, non-condensing
ELECTRICAL SUPPLY:	120VAC or 240VAC
VOLTAGE TOLERANCE:	±10% of normal rated line
TEMPERATURE:	15ºC to 40ºC
PRODUCT USAGE:	This product is intended for use indoors **only**

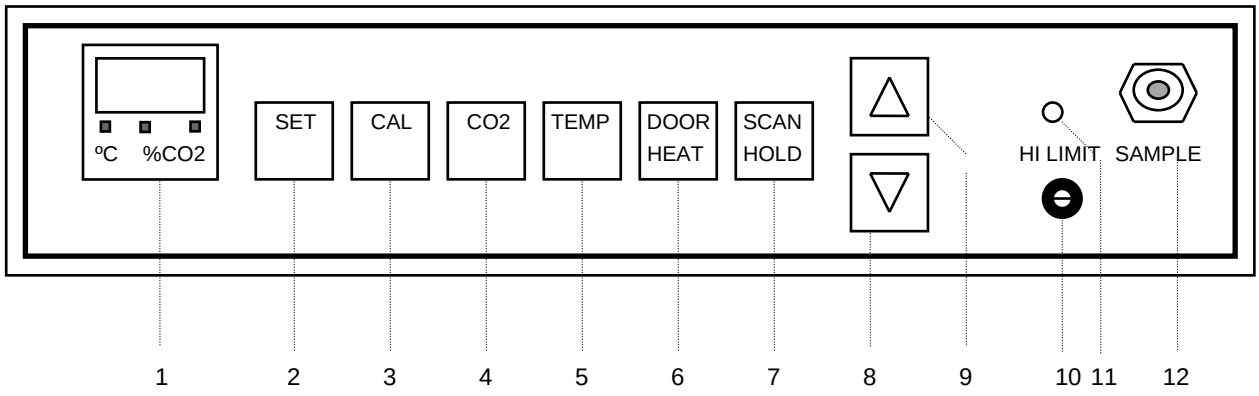
SECTION 4

FEATURES

The control panel for all models has a series of command keys which enables the user to enter set point values for temperature, carbon dioxide, door

heat and to calibrate the unit as required. LED readouts provide the user with current status information regarding the foregoing parameters.

CONTROL PANEL:



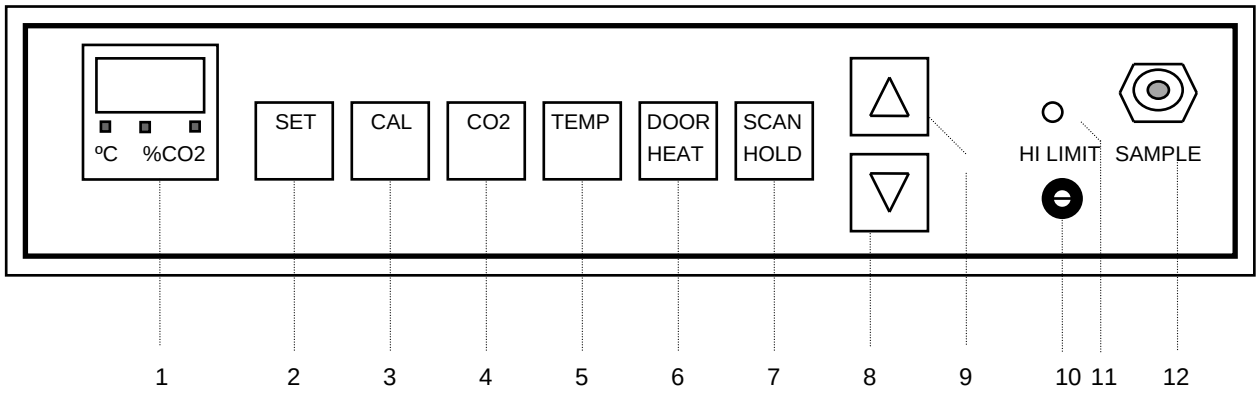
1. LED READOUT: The LED displays current CO_2 tension and temperature in the Incubator and, in the set mode, displays the set point values for these two parameters as well as door heat setting. It also enables the user to enter values necessary to calibrate temperature and CO_2. Indicating lights and legends serve to identify which parameter is being displayed.

2. SET COMMAND KEY: The **SET** key is the beginning point for and initiates subsequent actions of the other keys on the control panel.

3. CAL COMMAND KEY: The **CAL** key permits calibration of temperature and CO_2 when in this command mode. The Up and Down arrow keys are used to change the readout to correspond with the readings obtained from known standards of temperature or CO_2 measurement. Both temperature and CO_2 calibration use the zero point shift method.

FEATURES: (Con't)

CONTROL PANEL: (Con't)



4. CO_2 COMMAND KEY: Pressing the **SET** key and then the **CO_2** key allows the user with the Up and Down keys to enter the desired carbon dioxide level in the Incubator.

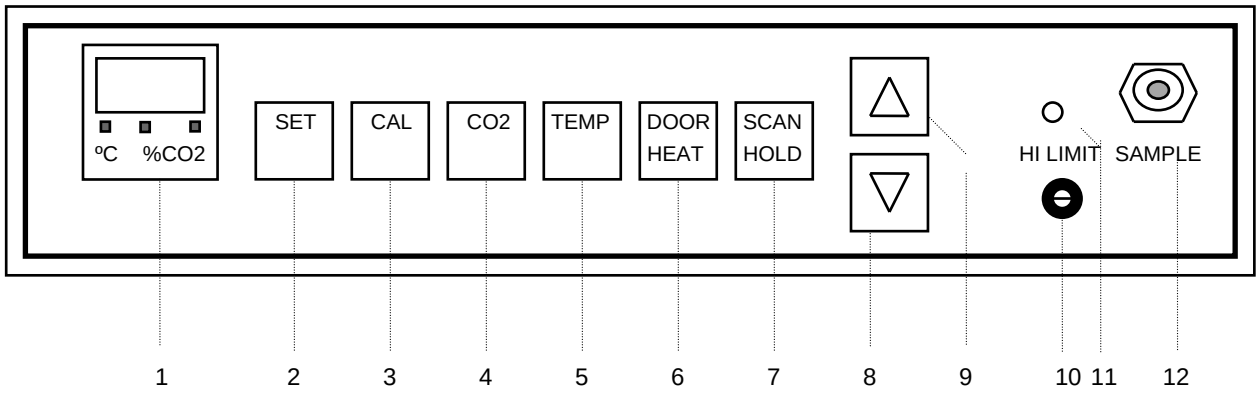
   - High and low limit alarm set points are factory set at ±1% above and below the user-established set point. In the event CO_2 exceeds the indicated limits, an audible alarm will sound and indicating light above the key will flash.

   - Pressing any key will silence the alarm for a period of one hour. The user should immediately investigate the reason for the alarm and take steps to correct the problem. Note that the indicating light continues to flash. If a problem is not solved the alarm resumes.

   - By pressing the CAL (#3) and CO_2 (#4) keys sequentially users can calibrate CO_2. The Up and Down arrow keys will change the readout to correspond with the readings obtained from known standards of CO_2 measurement.

FEATURES: (Con't)

CONTROL PANEL: (Con't)



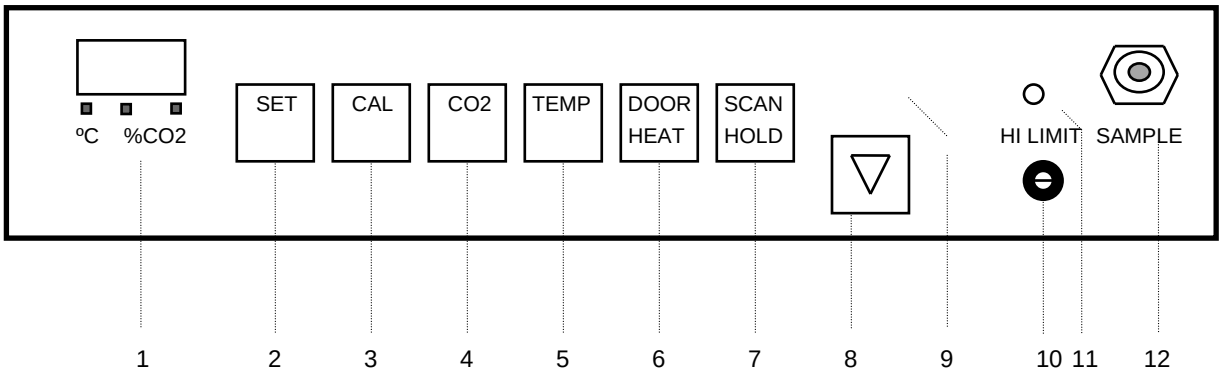
5. TEMP COMMAND KEY: Pressing the **SET** key and then the **TEMP** command key allows the user with the Up and Down arrow keys to establish the desired set point temperature in the Incubator.

- High and low limit alarm set points are factory-set at ±1ºC. If the temperature deviates from these limits, an audible, continuous alarm will sound and the temperature lamp will flash.
- While pressing any key will silence the alarm for a one-hour period, the user should immediately investigate the reason for the alarm and take steps to correct the problem. Note that indicating light continues to flash. If problem is not corrected, the alarm will resume after one hour has passed.
- By pressing the CAL (#3) and TEMP (#5) keys sequentially users can calibrate temperature. The Up and Down arrow keys will change the readout to correspond with the readings obtained from known standards of temperature measurement.

NOTE: DECREASES IN TEMPERATURE AND CO2 DUE TO NORMAL DOOR OPENINGS ARE TOLERATED WITHOUT INITIATING THE ALARMS.

FEATURES: (Con't)

CONTROL PANEL: (Con't)



6. DOOR HEAT COMMAND KEY:

   - When the **SET** key is pressed followed by the **DOOR-HEAT** key, the level of heat can be entered with the Up and Down keys as a percentage value being applied to the inner glass door.
   - A flashing **DOOR-HEAT** indicator light above the key indicates that heat is being applied to the inner glass door.
   - A good starting point for the door heat control is 35%; if fogging still occurs, increase in 10% increments until fogging disappears.

7. SCAN/HOLD COMMAND KEY: Permits holding the value of a single parameter for continued viewing or scans alternately between the values of the two parameters on a 2-second interval.

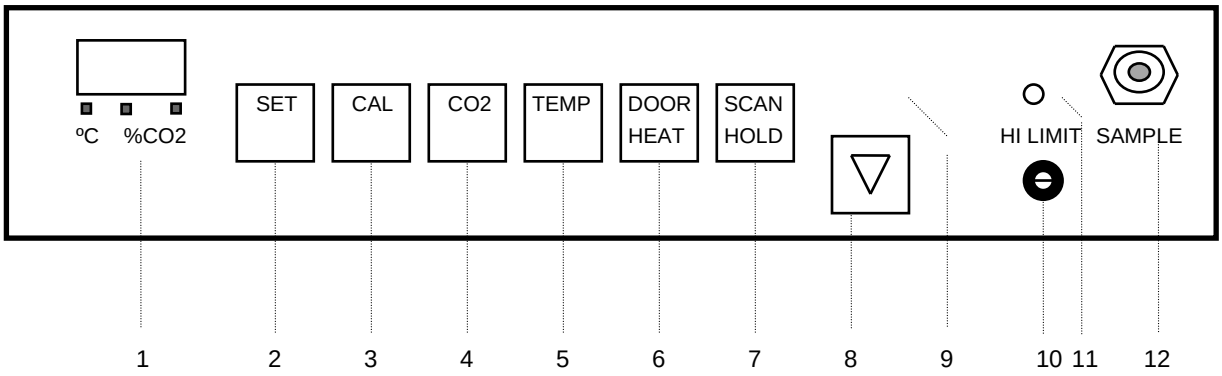
8. DOWN-ARROW KEY: This key decreases numerical value of the parameter which has been accessed.

9. UP-ARROW KEY: This key increases the numerical value of the parameter that has been accessed.

NOTE: A 5 SECOND DELAY AFTER ANY FINAL ENTRY RESULTS IN **AUTOMATIC ENTRY** OF THAT CHANGE.

FEATURES: (Con't)

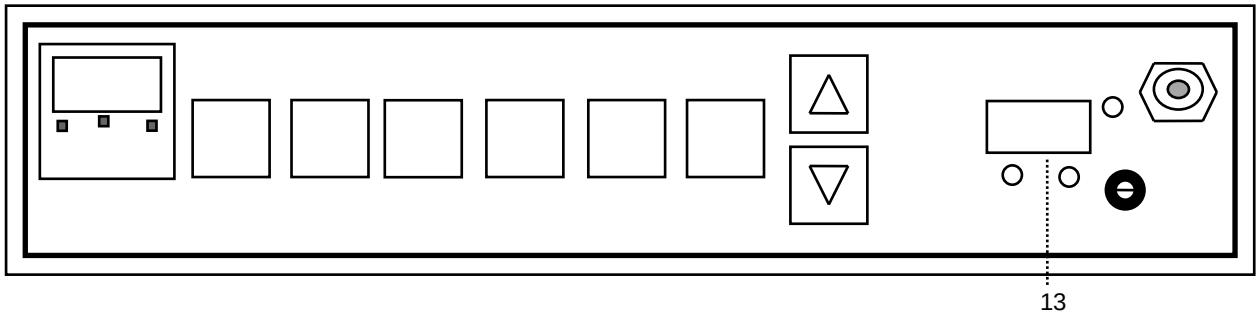
CONTROL PANEL: (Con't)



10. HI-LIMIT THERMOSTAT: This is a backup temperature controller that takes charge in the event the microprocessor fails. The hi-limit thermostat will then control the temperature at slightly above the set point.

11. HI-LIMIT STATUS LAMP: Indicates when the hi-limit is active.

12. SAMPLE PORT: This access port is available for sampling the atmosphere in the chamber when executing calibration procedure such as might be done using a Fyrite or similar chemical-based CO_2 analysis procedure.



13. LED RH DISPLAY; MODELS 460RH, 465RH, 490RH, 495RH, 495-1RH *ONLY*: Indicates the actual relative humidity within the chamber.

FEATURES: (Con't)

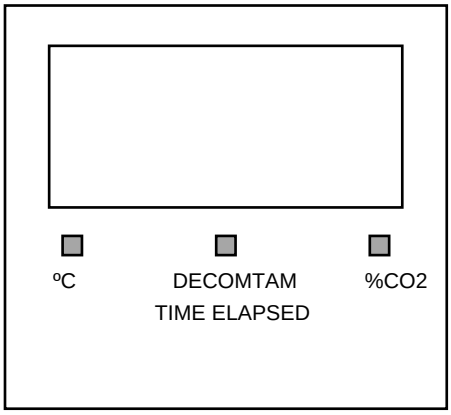
WATER-JACKETED MODELS:

LED READOUT DISPLAY:

LOW WATER INDICATING LIGHT: Low water conditions can be detrimental to chamber integrity, as well as temperature control. To warn of this condition, a solid green light will appear just below the LED display area to remind the user to take corrective action, i.e. add water.

AIR-JACKETED MODELS:

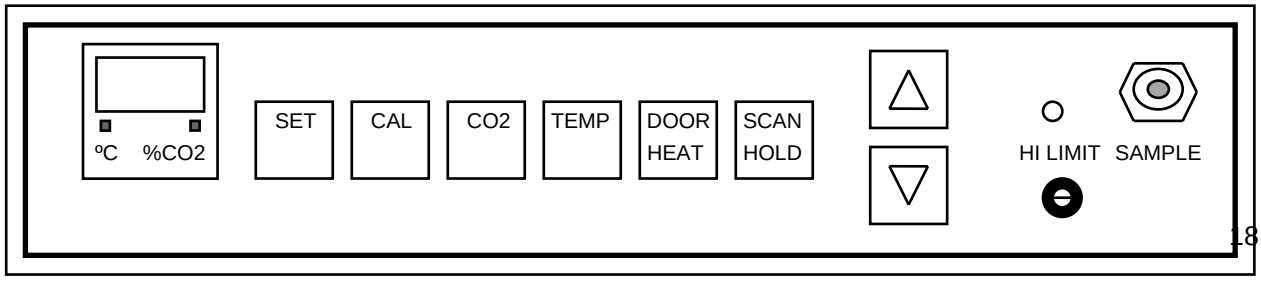
LED READOUT DISPLAY:



DECONTAM™ TIME ELAPSED INDICATING LIGHT: When a DECONTAM cycle is initiated in radiant warm wall models, the indicating light below the readout will be lit and the time elapsed (hours, minutes) will be displayed.

FEATURES: (Con't)

CONTROL PANEL: (Con't)



1 2 3 4 (5) (6)

PROPER SEQUENCING IS IMPORTANT IN OPERATING COMMAND KEYS:

To enter commands correctly, it is important to press the keys in **SEQUENCE**. Do not hold down one key and press another key—the action will not be accepted by the system. The following is the proper sequence in which to press the keys for the indicated actions:

SET(#1), TEMP(#4):	View existing value, retain or change set point using Up and Down keys.
SET(#1), CO_2 (#3):	View existing value, retain or change set point using Up and Down keys.
SET(#1), DOOR HEAT(#5):	View existing value, retain or change set point using Up and Down keys.
CAL(#2), TEMP(#4):	Calibrate temperature using Up and Down keys.
CAL(#2), CO_2 (#3):	Calibrate carbon dioxide using Up and Down keys.
CO_2 (#3), CAL(#2), SET(#1):	Install password using Up and Down keys.
TEMP(#4), CAL(#2), SET(#1):	Disable password using UP and DOWN keys.
SCAN/HOLD(#6):	Each individual contact of key advances to one of 3 options: A) continuous viewing of temperature; B) continuous viewing of carbon dioxide; C) an alternating viewing of the two.

FEATURES: (Con't)

ALARMS:

POWER OUTAGE: In the event of a power outage, the LED display will flash to alert the user to take corrective action. If the power outage is of a temporary nature, pressing any key will restore unit to operating status. Everything operates normally after a power outage.

DOOR AJAR WARNING: In case the door is inadvertently left open beyond a 5 minute period, an audible beep is sounded and is synchronized with the flashing of the DOOR-HEAT indicator light to warn the user to correct the condition.

AUDIBLE AND VISUAL ALARMS: The following table summarizes the audible and visual alarms that are initiated upon the occurrence of various events.

	AUDIBLE BEEP	FLASHING LIGHT ABOVE KEY	FLASHING LED DISPLAY
Temp (exceeds limits):	YES	YES	NO
CO_2 (exceeds limits):	YES	YES	NO
Door Ajar:	YES	YES	NO
Power Out:	NO	NO	YES
Low Water, 460/465 SERIES:	NO	STEADY	NO

Press any key to silence alarm that will remain silent for a period of one hour. However, the flashing light will continue. If the condition initiating the alarm remains uncorrected at the end of that time, the audible alarm will resume.

PASSWORD:

In the event that you want to prevent unauthorized access to the operation of the unit, a password feature is available.

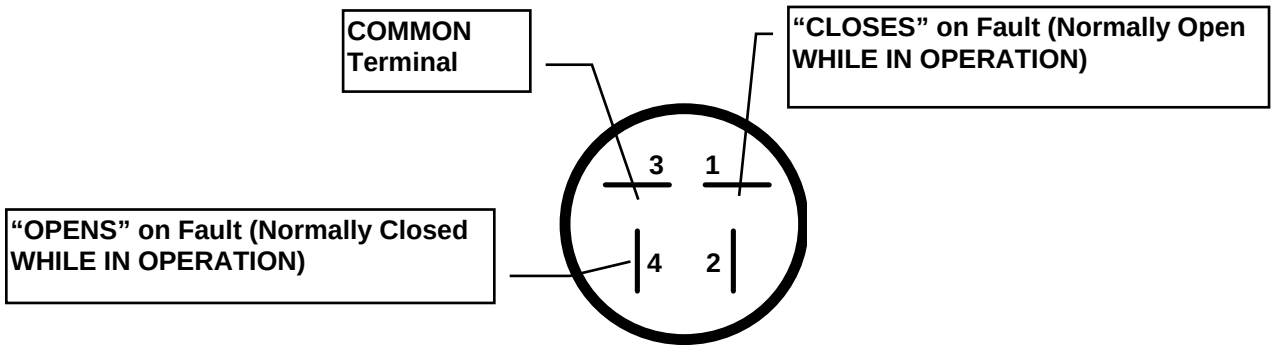
FEATURES: (Con't)

OPTIONAL ALARM RELAY OUTPUT: REAR OF UNIT

The incubator incorporates an output on the rear panel for use as a central alarm voltage-free ("dry contacts") connection port. This output may be tied in with any central alarm system to give notice of any alarm condition: High or Low Temperature, High or Low CO2, Low Water Level (water jacket models), Power Outage or Door Opened.

A standard relay is used and is normally energized while the incubator is in operation. Common, Normally Open, and Normally Closed pin outputs are routed to the rear panel for user access. Enclosed with the incubator is **a mating connector** that can be customer wired and used for interfacing with a Central Alarm.

NOTE: The connector is polarized. The rear panel outputs are as shown here:



RELAY OUTPUTS LOCATED ON REAR PANEL

The following ratings are for connection purposes: **MAX 5A @ 34VDC or 34VAC**

SECTION 5

INSTALLATION

√*SHIPPING CARTON:*

This should be inspected upon delivery. When received, carefully examine for any shipping damage before unpacking. If damage is discovered, the delivering carrier should both specify and sign for the damage on your copy of the delivery receipt.

Open the carton carefully making certain that all parts are accounted for before packaging materials are discarded. After unpacking, if damage is found, promptly report it to the carrier and request a damage inspection promptly.

IMPORTANT: Failure to request an inspection of damage within a few days after receipt of shipment absolves the carrier from any liability for damage. You must call for a damage inspection promptly.

LOCATION:

Place the unit where it will be used, away from external vibration sources, drafts and wide variations in ambient temperature. Choose a location near a power supply that matches the unit nameplate requirements.

CAUTION: THIS UNIT IS DESIGNED FOR USE WITH GASEOUS AIR, CO_2 OR NITROGEN ONLY. DO NOT USE WITH ANY OTHER GASES. FAILURE TO OBSERVE THESE PRECAUTIONS CAN RESULT IN EXPLOSION AND/OR FIRE AND SERIOUS INJURY AND/OR DEATH AND PROPERTY DAMAGE.

LEVELING:

Level the unit by using a bubble-type level placed on a shelf. Turn the leveling feet clockwise to raise and counterclockwise to lower the height of the respective legs of the Incubator. The unit should be level from front to back and side to side.

ELECTRICAL REQUIREMENTS:

120 VAC models require a 120 VAC, 50/60 Hz power source. They are supplied with a 3-wire line cord that should be plugged into an outlet designed for 3-prong plugs. If an extension cord is used, it also should be the 3-wire grounded type. For an outlet designed to accept 2-prong plugs, ungrounded, it is required that a qualified electrician replace the outlet with a new grounded type.

240 VAC models require a 240 VAC, 50/60 Hz power source. Because of the variety of plug configurations in use worldwide for 240 VAC power, the unit is furnished with the plug removed. The user must install a plug to conform with local code and configuration requirements.

100 VAC models require a 100 VAC, 50/60 Hz power source. Because of the variety of plug configurations in use worldwide for 100 VAC power, the unit is furnished with the plug removed. The user must install a plug to conform with local code and configuration requirements.

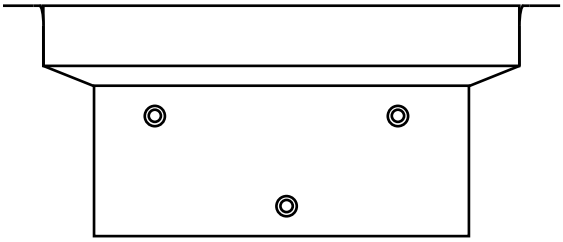
If a plug must be installed, use only the 3-prong grounded type, rated for the unit load requirements and matching the power outlet. Make sure the green ground wire is secured to the plug ground terminal.

NOTE: LEAVE UNIT DISCONNECTED WHEN NOT IN USE.

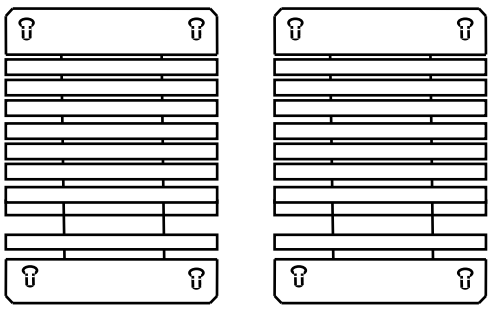
INSTALLATION: (Con't)

SHELVING/PLENUM INSTALLATION-SELF-SUPPORTING SYSTEM COMPONENTS,

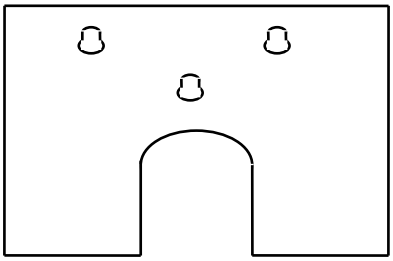
TOP PLENUM



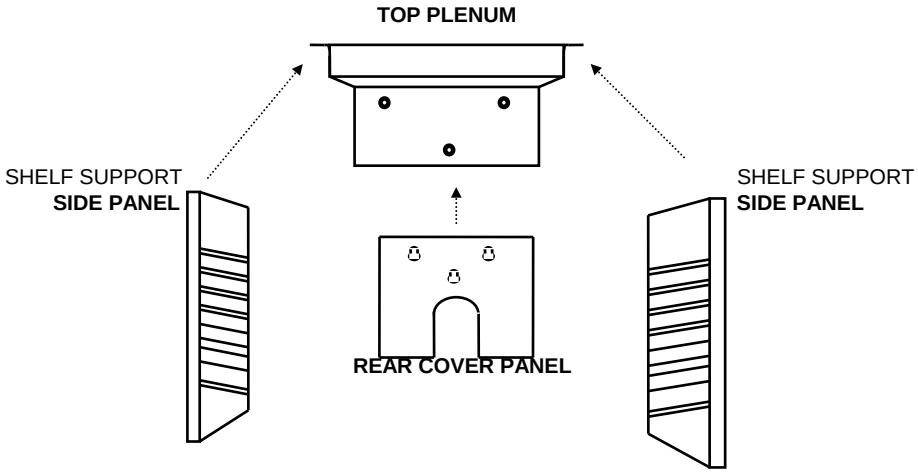
SHELF SUPPORT SIDE PANELS



REAR COVER PANEL



SHELVING/PLENUM INSTALLATION-SELF-SUPPORTING SYSTEM ASSEMBLED

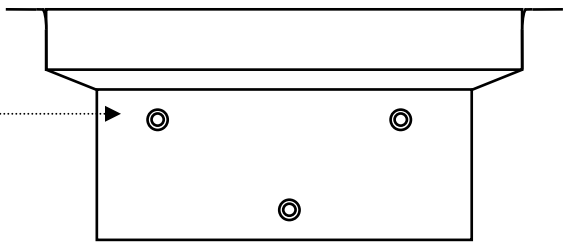


INSTALLATION: (Con't)

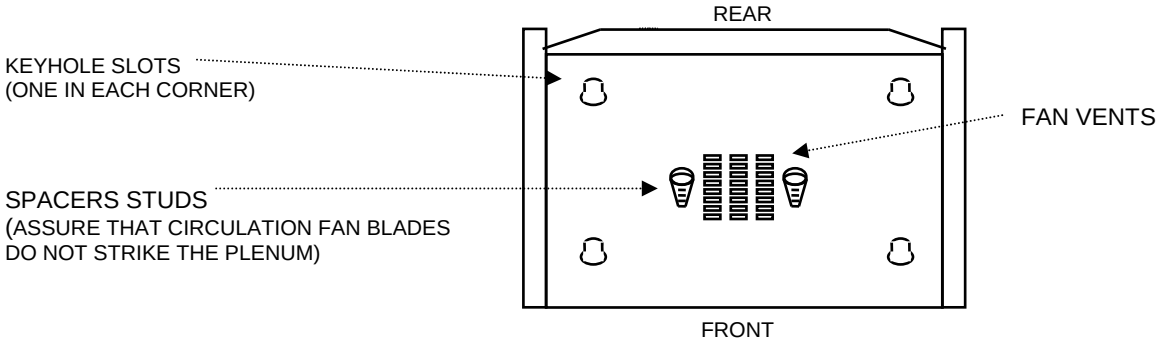
SHELVING AND PLENUM INSTALLATION-4 STEPS:

NOTE: NO TOOLS OR FASTENERS ARE REQUIRED. THE COMPONENTS FIT TOGETHER BY HANGING FROM STANDOFFS.

TOP PLENUM, HEAD-ON VIEW:



TOP PLENUM, DOWN VIEW:

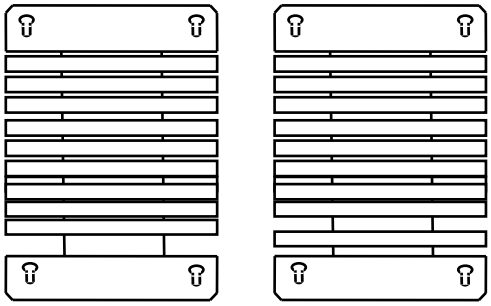


1. Open the outer and inner front chamber doors. Hold the top plenum with the spacer studs up and the keyway studs toward the rear. Tilt the panel at an angle and carefully move it into the chamber while lifting and centering it at the top of the chamber. Insert the larger keyhole slots located at the plenum's corners over the four studs suspended from the chamber ceiling. Slide the top plenum toward the rear of the chamber locking the plenum into place on the studs.

INSTALLATION: (Con't)

SHELVING AND PLENUM INSTALLATION: (Con't)

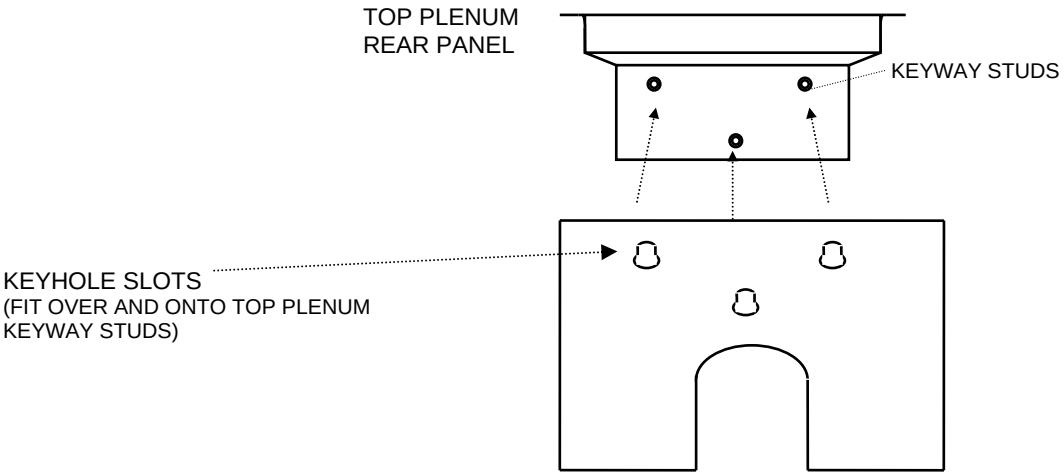
SHELF SUPPORT SIDE PANELS (2), HEAD ON VIEW:



2. With the top plenum properly secured to the chamber ceiling, a space on each side of the plenum is created into which the top of each of

the shelf support side panels will fit. Tilt a support side panel at an angle and move it into the chamber. Carefully slide the panel over the studs protruding from one side of the chamber wall and lock it into place. Repeat this procedure on the other side to install the second side panel.

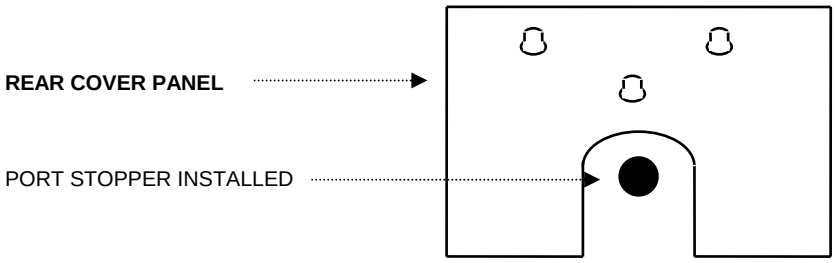
REAR COVER PANEL, HEAD-ON VIEW:



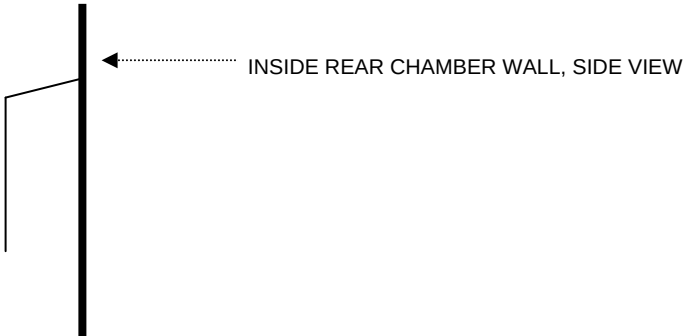
3. Move the rear cover panel into the chamber and place its keyhole slots over and onto the top plenum keyway studs, moving the back wall slots down and locking them onto the keyway studs.

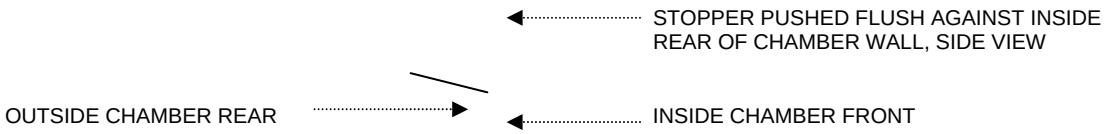
INSTALLATION: (Con't)

PORT STOPPER:

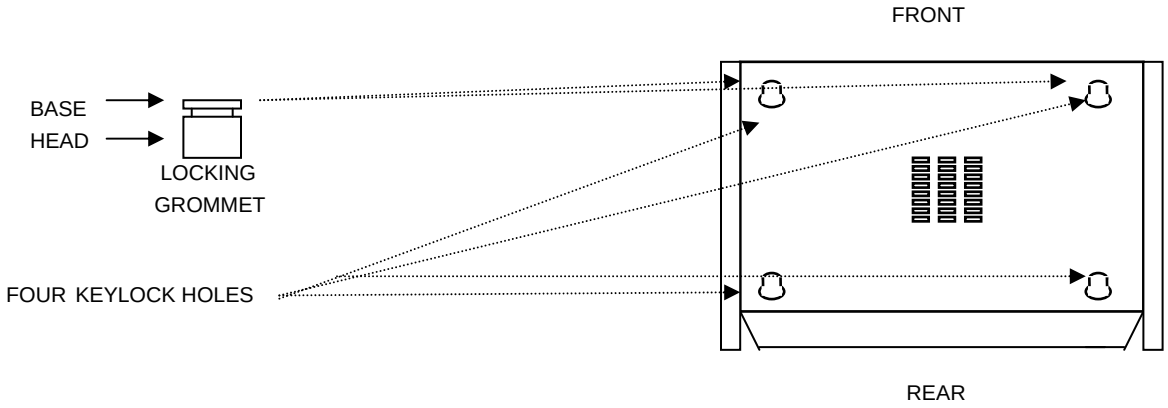


Insert the inner, narrower edge of the port stopper into the port opening located on the rear chamber wall. Make sure the outer, wider edge is flush with the rear interior chamber wall.





TOP PLENUM, UP VIEW:



4. Press a locking grommet, two supplied, into the two front keyhole slots adjacent to the stud from which the top plenum is secured. Make sure that the entire head of the locking grommet is inserted into the keyhole slot. This prevents the top plenum from being accidentally pulled out.

INSTALLATION: (Con't)

INSTALLATION OF GAS FILTER INTERFACE ASSEMBLY KIT #018-514-00:

KIT #018-514-00 INCLUDES:

- 4, Hose Clamps (#250-331-00)
- 1, In-Line Filter (#525-034-00)
- 1, 10 ft. (4.57m) length of 1/4" (6.35mm) ID PVC tubing (#720-418-00)

INSTALLATION PROCEDURE:

See next page for illustration.

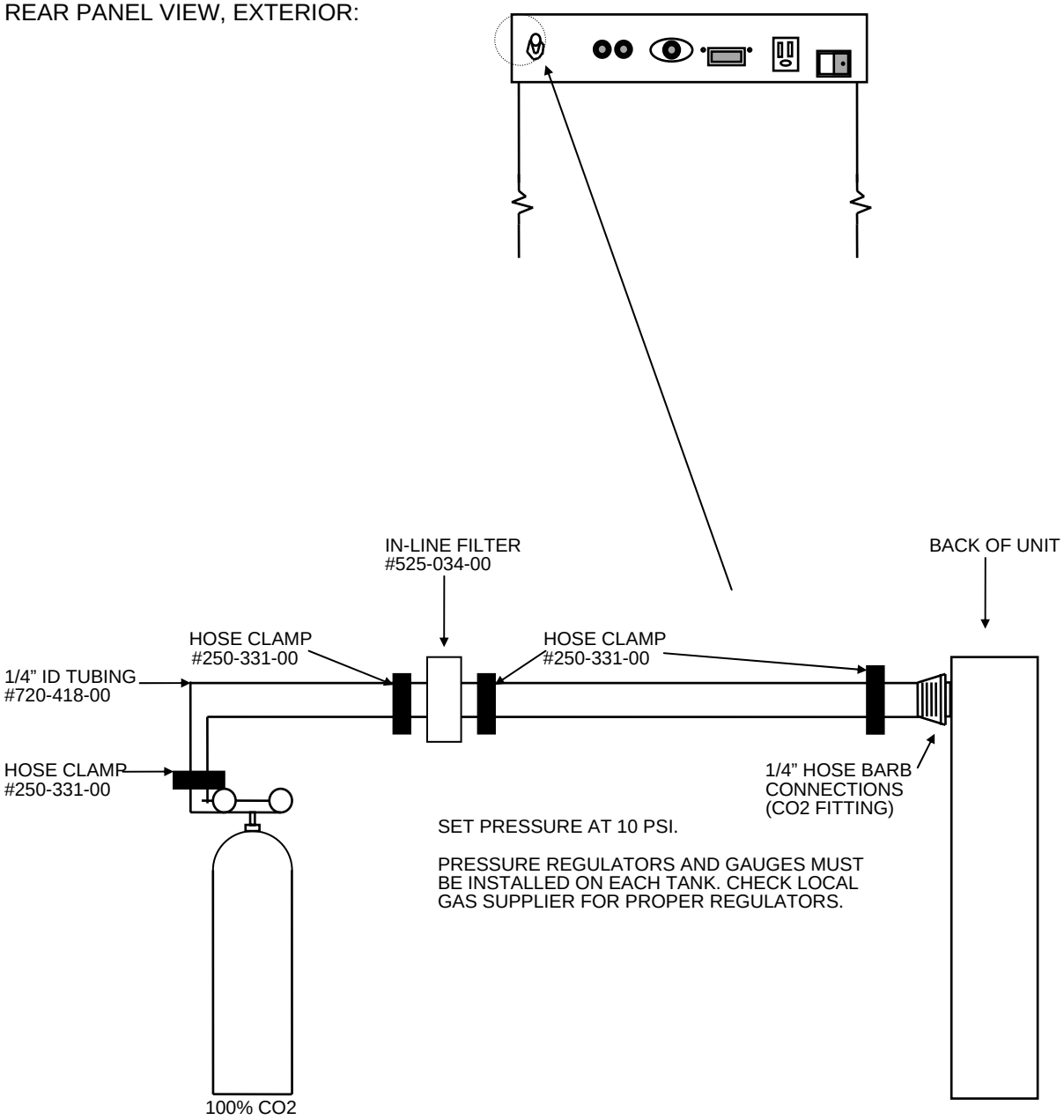
- Turn the unit power switch to the **OFF** position.
- Connect tubing to CO_2 tank gas outlet.
- Connect 1/4" (6.35 mm) ID tubing to hose barb on one side of in-line filter and secure with hose clamp; connect tubing to in-line filter hose barb on its other side and secure with hose clamp.
- Connect tubing with in-line filter in place to the appropriate gas inlet fitting on the back of the unit.
- Set the supply regulators at 10 psi.
- Check all of the connections for leaks.
- Turn the unit power switch to the **ON** position.

WARNING: HIGH CONCENTRATIONS OF CARBON DIOXIDE PRODUCE METABOLIC ABNORMALITIES, DISTURBANCES OF THE CENTRAL NERVOUS SYSTEM AND CARDIAC INSTABILITY. UNCONSCIOUSNESS MAY OCCUR AT CONCENTRATIONS ABOVE 10%.

INSTALLATION: (Con't)

INSTALLATION OF GAS FILTER INTERFACE ASSEMBLY KIT #018-514-00: (Con't)

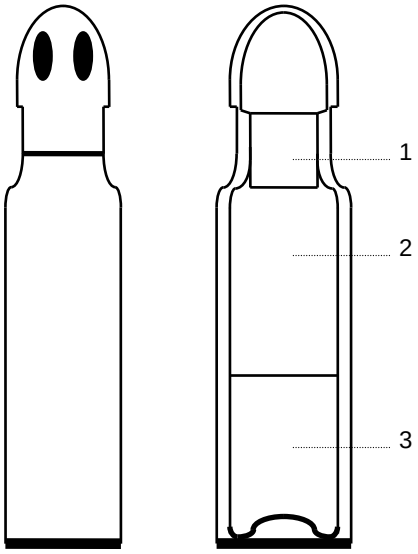
BACK OF UNIT
REAR PANEL VIEW, EXTERIOR:



INSTALLATION: (Con't)

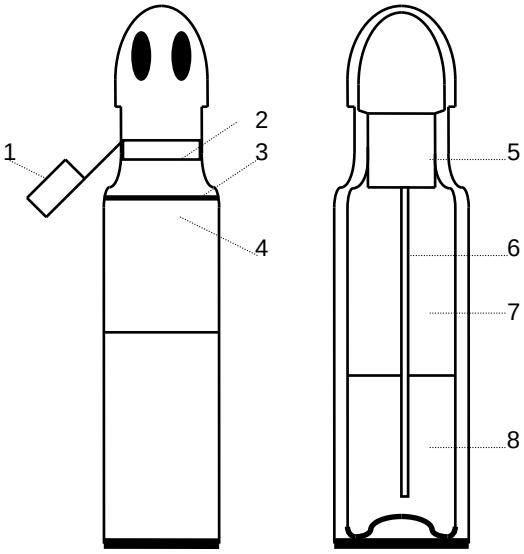
STANDARD AND SIPHON TYPE CO_2 GAS CYLINDERS

STANDARD TYPE (CORRECT)



1. Compressed Gas Association #320 connector.
2. Gas headspace.
3. Liquid CO_2 filled to 68% equal weight of water that cylinder would hold at 60ºF.

SIPHON TYPE (INCORRECT)



1. Warning tag indicating that cylinder is siphoning type.
2.* Aluminum ring.
3.* Gold band.
4.* Stamp or marking on cylinder: "Siphon" or "Eductor Tube".
5.* Valve should be of special type for service.
6.* Withdrawal tube draws up the liquid CO_2.
7.* Gas head space.
8.* Liquid CO_2 filled to 68% equal weight of water that cylinder will hold at 60ºF.

*__NOTE__: SOME GAS SUPPLIERS WILL HAVE NO MARKINGS TO INDICATE AN "EDUCTOR TUBE" OR "SIPHON" TYPE CYLINDER. BE SURE TO ORDER **DRY, LAB-GRADE CO2.**

Be sure to obtain a dual-stage regulator from the gas supplier for the CO_2 tank that is to be installed according to local codes.

INSTALLATION: (Con't)

460 SERIES, WATER-JACKETED MODELS, FILLING WITH WATER:

Capacity of the water jacket is 10.7 gallons/40.5 liters of water. Fill the jacket only with distilled water. For optimum Incubator life, use a distilled water with an electrical resistivity of 500,000 ohms to 1 MEG ohm maximum, as measured between opposite faces of a centimeter cube of an aqueous solution per ASTM D 1125-82.

WE DO NOT RECOMMEND USING 18 MEG OHM DEIONIZED WATER. If this is the only source of treated water available, mix with regular tap water to dilute to 1 MEG ohm maximum.

As a protection against the growth of fungi, a quality fungicide can be added according to the use ratio, parts compound versus capacity of water jacket, of the selected compound. Follow manufacturer's instructions completely.

CAUTION: TO PREVENT DAMAGE TO THE WATER CHAMBER, DO NOT ADD WATER AT A HIGH FLOW RATE OR AT HIGH PRESSURE.

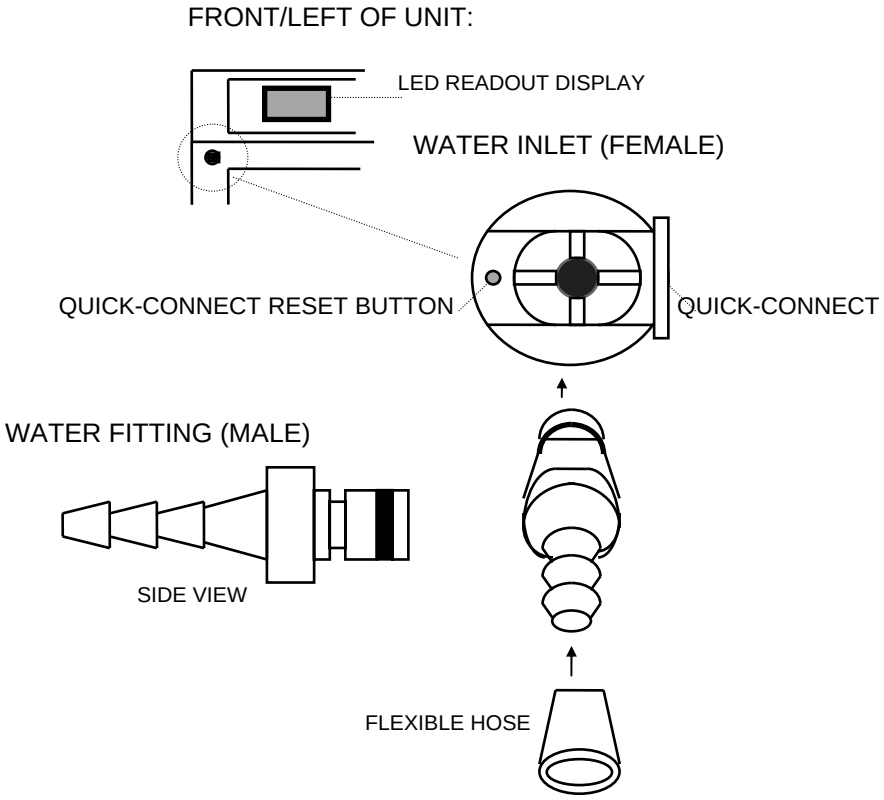
CAUTION: AIR VENT FOR WATER-JACKET IS SMALL PIPE ON THE LEFT HAND SIDE OF THE BACK OF THE UNIT AND MUST BE KEPT FREE OF ALL OBSTRUCTIONS TO ALLOW AIR TO ESCAPE. THE INCUBATOR CHAMBER CAN BE DAMAGED FROM PRESSURE BUILD-UP FROM EXPANSION AND CONTRACTION DURING HEATING AND COOLING CYCLES.

INSTALLATION: (Con't)

INITIAL FILLING OF WATER JACKET, 460 SERIES:

1. Turn unit on. The low-water LED will display a low-water message.

2. To fill the water jacket, open the unit's front door and locate water inlet, top left under front control panel.



3. Verify overflow outlet on rear of unit is not obstructed. Connect a ¼" (6.35 mm) ID piece of tubing to overflow outlet and place other end of tubing in a 1 liter container to catch any possible overflow.

4. Attach appropriately sized tubing from distilled water source to the water inlet.

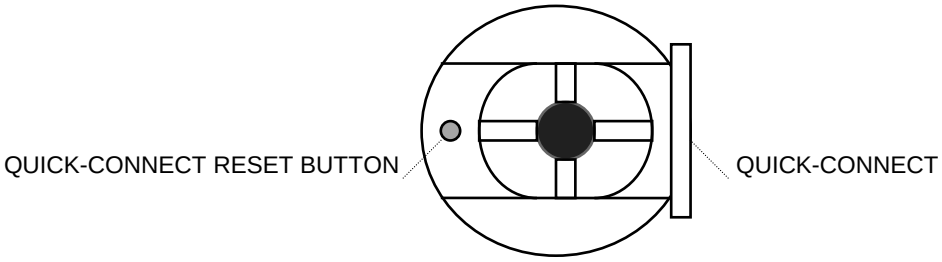
5. Turn distilled water source on. Flow rate should not be greater than 1 liter/minute.

6. Monitor low-water light on control panel until it goes out and immediately stop filling procedure—turn off the distilled water source WITHIN THE NEXT FEW SECONDS, all excess water will run from the overflow outlet located at the rear of the unit.

INSTALLATION: (Con't)

460 SERIES:

NOTE: PUSH THE QUICK-CONNECT ON THE WATER INLET UNTIL IT CLICKS BEFORE INSERTING TUBING TO INSURE A SECURE CONNECTION. THE SMALL QUICK-CONNECT RESET BUTTON ON THE LEFT SIDE OF THE WATER INLET CAN BE PUSHED IF THE WATER INLET WAS INADVERTENTLY SET.



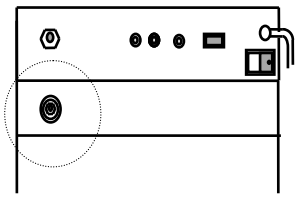
CAUTION: TO PREVENT DAMAGE TO THE WATER CHAMBER, DO NOT ADD WATER AT A HIGH FLOW RATE OR AT A HIGH PRESSURE.

WATER OVERFLOW OUTLET:

- Connect appropriate-sized tubing from the water flow outlet (circled) to a sink, floor drain or in an adequately sized receptacle (bucket, large pan).

BE ADVISED: IT IS RECOMMENDED THAT WHEN FILLING THE UNIT IT SHOULD NOT BE LEFT UNATTENDED. A SURPRISING LARGE AMOUNT OF WATER CAN RUN FROM THE WATER OVERFLOW OUTLET WITHIN A FEW SECONDS AFTER FILLING.

UNIT REAR PANEL: WATER OVERFLOW OUTLET (CIRCLED)



INSTALLATION: (Con't)

DRAINING OF WATER JACKET, 460 SERIES:

With the use of distilled water, periodic draining and refilling of the water jacket is not necessary. In the event the incubator is moved however, the water jacket should be drained. The drain is located at the left front bottom of the cabinet and is opened when the 1/4" adapter fitting (supplied with the unit) is inserted.

- Disconnect unit from electrical power.
- Connect the barbed end of the adapter fitting to appropriate-sized tubing. Place the other end of the tubing in a sink, floor drain or in an adequately sized receptacle (bucket or large pan). Connect the other end of the fitting to the incubator.
- Leaving drain tube connected, flush with distilled water to remove any possible deposits within the water jacket.
- Disconnect the adapter fitting and add 500 ml of quality rust preventative such as ethylene glycol.

Fill water jacket per instructions on page 32.

HUMIDIFICATION (if required):

As a preventive measure against mineral deposit build-up, **USE ONLY DISTILLED WATER**. Mineral deposits can affect the CO_2 control. Check water level at intervals to maintain conditions of humidity required for work being done.

To humidify the chamber atmosphere, use the stainless steel pan which is included, pouring distilled water into it. DO NOT flood the bottom of the chamber with water.

While the addition of a fungicide to the water will assist in controlling contamination, it may also affect the results of experiments conducted with cells, viruses and other materials. These factors should be taken into account when deciding to use or not to use a fungicide.

SECTION 6

OPERATION

DANGER: DO NOT USE IN THE PRESENCE OF FLAMMABLE OR COMBUSTIBLE MATERIALS OR EXPLOSIVE GASES. DO NOT USE IN THE PRESENCE OF PRESSURIZED OR SEALED CONTAINERS—FIRE OR EXPLOSION MAY RESULT, CAUSING DEATH OR SEVERE INJURY.

WARNING: DO NOT HEAT ANY SUBSTANCE ABOVE A TEMPERATURE WHICH WILL CAUSE IT TO EMIT TOXIC FUMES—DEATH OR SEVERE INJURY MAY RESULT.

DANGER: USE ONLY AN INERT GAS SUCH AS CARBON DIOXIDE IN THE INCUBATOR. DO NOT **UNDER ANY CIRCUMSTANCE** INJECT OXYGEN OR OTHER EXPLOSIVE GAS OR MIXTURE INTO UNIT. FAILURE TO OBSERVE THESE PRECAUTIONS CAN RESULT IN EXPLOSION AND/OR FIRE AND SERIOUS INJURY OR DEATH TO PERSONNEL AND PROPERTY DAMAGE

START-UP:

- Connect unit to power supply meeting the requirements as noted on the nameplate.
- Turn on the Incubator with rocker switch that is located on back left side.
- All display segments and parameter lamps should light for 5 seconds.

OPERATING BASICS:

- Press the **SET** key first and then the parameter—**CO_2, TEMP, DOOR HEAT**—which is to be adjusted.
- Use the UP and DOWN arrow keys to enter the desired value.
- Wait 5 seconds and the value is entered automatically into the unit's nonvolatile memory. Storage is confirmed via 2 short beeps at the end of 5 seconds.
- If you access a parameter and initiate no action within the time frame of 10 seconds, the unit times out and returns to the prior state.
- Each press of the **SCAN/HOLD** key is programmed to follow a sequential pattern as follows: HOLD temperature (for continuous viewing), HOLD CO_2 (for continuous viewing) and alternate scanning of temperature and CO_2.
- To view your previously established set point for any parameter, press **SET** and the **TEMP, CO2** or **DOOR HEAT** key(s)—unit will revert to its normal display after 10 seconds.

OPERATION: (Con't)

PASSWORD FEATURE:

1. To prevent unauthorized entry to values which have been set, a password feature is available with your unit.

2. SET, CAL, CO_2 and TEMP keys have the numbers **1**, **2**, **3** and **4** below that are used to enter or disable a password. Select a 3-digit password from 001 through 999 FYI: 000 is not a valid password). After power up and after pressing any key, press **3**, **2** and **1** in sequence (i.e. CO_2, CAL and SET); enter your numerical password by using the UP or DOWN arrow key.

3. Once your password is entered, wait 5 seconds and the unit will store this value in its nonvolatile memory. REMEMBER TO NOTE THE PASSWORD IN A PLACE FOR SAFEKEEPING AND ACCESSIBLE TO YOURSELF OR A COLLEAGUE.

4. Subsequent access is denied unless the correct password is entered. Any keystroke will display **00** and YOU HAVE 5 SECONDS within which to enter the correct password using the UP or DOWN arrow key.

5. To disable the password: enter the password, wait for - - - to appear on the readout, enter **4, 2**, **1** (i.e. TEMP, CAL and SET) and the password is disabled.

SETTING OPERATING TEMPERATURE AND HI-LIMIT SETPOINT:

- Press the **SET** and **TEMP** keys sequentially and using the UP and DOWN arrow keys, select the set point temperature.

- Rotate the **HI LIMIT** thermostat fully clockwise.

- Set CO_2 set point to zero—accuracy will not be achieved until the temperature has stabilized.

    - θ Press the **SET** and **CO2** keys sequentially and using the UP and DOWN arrow keys, adjust LED readout until a value of 00.0 is obtained.

    - θ Wait 5 seconds to finalize the selection.

- Allow sufficient time for the unit to reach and stabilize at the set point temperature plus an additional hour or two for unit to cycle at the temperature—**4 HOURS FOR 37ºC IS TYPICAL**.

OPERATION: (Con't)

SETTING OPERATING TEMPERATURE AND HI-LIMIT SETPOINT: (Con't)

- After this time has elapsed, rotate the HI-LIMIT thermostat counterclockwise while watching the red lamp. When the lamp is lit, you have adjusted the **HI-LIMIT** set point to be equal to the operating set point.

  NOTE: DO NOT LEAVE HI-LIMIT AT THIS SETTING

- Now rotate the **HI-LIMIT** thermostat clockwise 30 degrees of rotation past the point where the lamp goes out. **THIS DISTANCE SHOULD BE SIMILAR TO THE DISTANCE FROM THE TWELVE O'CLOCK TO THE ONE O'CLOCK POSITIONS**. This establishes a buffer of a few degrees between the operating set point and the HI-LIMIT temperature set point and allows PID control to function normally.

  NOTE: UNDER NORMAL OPERATING CONDITIONS, THE **HI-LIMIT LED** SHOULD **NEVER** COME ON. IF IT DOES, READJUST SLIGHTLY CLOCKWISE.

CONDENSATION ON INNER GLASS DOOR:

- After the unit has been operating, you can determine what, if any, condensation is forming on the inner glass door. To dissipate condensation, press the **SET** and **DOOR HEAT** keys to access this function.

- Using the UP and DOWN arrow keys, select a value as a percentage of the heater output. Heat will be applied by setting the door heat percentage. Each % translates into 0.5 Watts of door heat. For example, 10 will produce 10% of the available heating capacity. As experience is gained through trial and error, you will be able to select more precisely the heating value required to remove any condensation. As a general starting point, 30% at 37^{o}C may be selected.

- Correct setting of the door heat control depends on varying factors such as chamber temperature and whether or not you choose to add water (humidity) into the chamber. In general, the setting should be to produce the minimal amount of heat necessary to eliminate glass door condensation and no more. If unsure of the amount of heat to produce, start at a low value and increment the setting by 5% every couple of hours until condensation is eliminated. Once set, the door heat percentage need not be changed again, unless you change the temperature set point and/or your humidity requirements. The setting you choose is, of course, stored in non-volatile RAM memory in case of power outages.

OPERATION: (Con't)

DECONTAM™ PROCEDURE: AIR JACKETED MODELS WITH THERMAL CONDUCTIVITY SENSOR ONLY:

The decontam cycle is initiated by sequentially pressing **SET**, **TEMP** and holding the UP arrow key until the temperature reaches 100ºC. The unit will hold this temperature for a period of 12 hours and the time elapsed during the cycle is displayed on the LED readout; the only way that the cycle can be aborted is by turning off the power switch.

DECONTAM™ WARNING:

DO NOT, UNDER ANY CIRCUMSTANCES, USE DECONTAM IN THE CHAMBER **WITH HUMIDIFICATION WATER PRESENT** INSIDE THE CHAMBER.

ALWAYS REMOVE ALL WATER BEFORE BEGINNING DECONTAM.

TEMPERATURE CALIBRATION:

The Incubator is calibrated at the factory. However, if required, the temperature readout may be calibrated by pressing the following keys in sequence: **CAL**, **TEMP**.

It is important to remember that opening or keeping the outer door open shuts off the chamber's air circulating fan. The door must be closed to operate the fan.

- Using a calibrated digital thermometer and a thermocouple, place the thermocouple in the approximate geometric center of the chamber.
- Allow sufficient time for the chamber temperature to stabilize.
- Use the UP and DOWN arrow keys to correct the displayed temperature on the LED readout to match your chamber temperature reading. Wait 5 seconds and the adjustment is self-entering.
- Be sure to shut the outer door in order to operate the fan to assure the circulation of air inside the chamber.

CO_2 CALIBRATION:

In like manner, the CO_2 reading can be calibrated against a known standard such as the Fyrite method of analyzing CO_2. To access the correct command mode, press the **CAL**, **CO2** keys sequentially.

Using a Fyrite or similar device, obtain the actual CO_2 tension in the chamber via the front panel CO_2 sample port.

If there is a difference between the Fyrite reading and LED display of CO_2, press **CAL** and **CO2** in sequence and use the UP and DOWN arrow keys to adjust the displayed CO_2 value to match the value obtained with the Fyrite or device of comparable accuracy and reliability.

All internal CO_2 parameters automatically track this change.

OPERATION: (Con't)

HINTS ON USING THE FYRITE*:

The following information is intended to supplement that found in the Fyrite manual and is based on experience working with users of our Incubators. One of the most important aspects of using the Fyrite procedure and one that is frequently overlooked is the condition of the fluid. The Fyrite accepts a sample of the Incubator's environment into its own chamber where it is absorbed by the Fyrite fluid to determine the CO_2 percentage or tension. Of special importance is keeping outside air from the sample drawn from the Incubator. Any outside air contaminating the sample is detrimental to an accurate reading, and,more importantly, to the growth of your cells.

Inspection of the fluid should be performed only with the user wearing protective gloves, as the Fyrite fluid is slightly corrosive. The inspection should review the following:

- THE DATE OF THE LAST FLUID CHANGE: Old fluid will not absorb as much CO_2 and will produce a false reading. This may lead the user to recalibrate the Incubator to higher CO_2 tensions that can prove lethal to cell cultures. Fyrite fluid should be changed after approximately 350 uses. This approximates a change of fluid once a year if the Fyrite procedure is carried out on a daily basis. Keep track of the number of uses and if the Fyrite is used with more than one Incubator. Experience shows that the color of the fluid is not as important as the age of fluid.

- CHECK THE CONTAINMENT VESSEL AND HOSES AT LEAST ONCE A MONTH: Make sure that there are no cracks in the vessel or leakage of fluid to the outside of the container. This can indicate a leaky seal or internal crack. Hoses should be stretched slightly and inspected for cracks or holes. This is critical as cracks and/or holes in the hoses can draw in outside ambient air and produce a false reading.

- CHECK THE FLUID DAILY AND ADJUST THE SLIDE GAUGE TO READ ZERO: If you have adjusted the slide gauge all the way down and the fluid level is still too low, place a couple of drops of distilled water into the plunger on the top of the Fyrite. Depress the plunger and the water will transfer into the Fyrite causing the fluid level to rise. Repeat this procedure until the fluid level reads correctly.

CAUTION: A LITTLE WATER GOES A LONG WAY— USE ONLY A COUPLE OF DROPS OF DISTILLED WATER AT A TIME.

CAUTION: DO NOT USE FYRITE FLUID TO ADJUST THE LEVEL OF FLUID USE DISTILLED WATER ONLY. THE ONLY TIME TO USE FRESH FYRITE FLUID IS WHEN YOU CHANGE IT DUE TO THE AGE OF THE FLUID.

*Trademark of Bacharach Instruments.

OPERATION: (Con't)

HINTS ON USING THE FYRITE: (Con't)

Inspect the Fyrite filter in the clear plastic casing between the hoses for any contamination or growth. Change it if necessary.

CAUTION: MAKE SURE THE FILTER IS MOIST BEFORE YOU TAKE YOUR READING. A MOIST FILTER IS A MUST FOR AN ACCURATE READING.

To moisten the filter, remove the end of the short hose without the squeeze bulb that connects to the Incubator. Add several drops of distilled water to the filter, replace the hose and squeeze the bulb. Release the bulb and the water will be drawn into the filter. Squeeze the bulb and quickly release it to remove any excess water. You will see this water (if any) come out of the end of hose that is closest to the squeeze bulb. This is the cupped end that is depressed onto the Fyrite.

TAKING A FYRITE READING:

It is recommended that Fyrite CO_2 and independent temperature tests be performed at intervals to be determined individually or as dictated by established protocol. Some laboratories conducting critical work may want to record CO_2 and temperature readings on a daily basis.

CAUTION: THE INCUBATOR MUST BE STABLE.

First, clear the Fyrite of any residue CO_2. Simply depress the plunger on the head or the top of the Fyrite taking care not to cover the hole—this introduces fresh ambient air into the Fyrite chamber. Release the plunger and turn the Fyrite upside down, holding it at a 45-degree angle until most of the bubbles surface and the fluid has filled the head. Even the smallest bubbles may contain CO_2, so that it is important to let most of the smaller bubbles surface.

Now turn it right side up and hold it at 45 degrees. Allow the fluid to fill the Fyrite and depress the plunger again—this clears the Fyrite of any CO_2 that might cause a false reading.

Next, attach the filter side of the hose to the Incubator's CO_2 sample port. Remove the brass tube, if present, from the Fyrite hose, as it is not needed and attach the hose to the CO_2 sample port. The brass tube was once used with older Incubators that utilized a hole in the Incubator wall or door to measure CO_2 but this method proved to cause contamination problems.

LOOK AT YOUR FYRITE GAUGE AND ADJUST THE ZERO IF NECESSARY.

Take the squeeze bulb end of the hose and with the hole of the cupped end facing down, place it onto the plunger of the Fyrite and hold it firmly in position.

IMPORTANT: ONCE YOU HAVE DEPRESSED THE PLUNGER OF THE FYRITE, IT IS CRITICAL THAT IT NOT BE RELEASED DURING THE FOLLOWING PROCEDURE.

OPERATION: (Con't)

TAKING A FYRITE READING: (Con't)

Depress the plunger and hold it down. It is very important not to allow the plunger to spring up—if this occurs. you will be repeating an already existing reading. It will not matter how many times you pump the squeeze bulb, as long as you hold the plunger down you will introduce only one sample to the Fyrite. But, by releasing the plunger and immediately pushing it back down, you will then be adding an additional sample to the Fyrite chamber causing the reading to double or triple. In the event that it is difficult to hold the plunger down while pumping the squeeze bulb, find a more suitable or comfortable position.

Without releasing the plunger, pump the squeeze bulb at least 20 to 30 times—this assures complete and thorough transfer of the sample to the Fyrite chamber. Once the bulb has been pumped the required number of times, **HOLD THE SQUEEZE BULB IN THE SQUEEZED-POSITION** and release the pressure on the cup which will also release the plunger. This traps the sample from the Incubator in the Fyrite chamber and allows the fluid to absorb the CO_2.

With the plunger now released, turn the Fyrite upside down again and hold at a 45-degree angle to allow the smaller bubbles to surface while the fluid fills the chamber head. Reverse and turn Fyrite right side up and hold at a 45-degree angle to allow the same thing to happen. Repeat this procedure—hold upside down at 45-degree angle and right-side up at 45-degree angle. Finish by shaking the Fyrite slightly while holding at 45-degree angle to allow residue droplets of fluid to drain into the measuring tube.

Read the gauge: It should match or be close to your CO_2 set point. It is possible that you may be off as much as ±3%. If you read more than 8%, it is possible that you may have introduced two samples or the Incubator is way out of calibration. If a wide variation between the reading and CO_2 set point exists, it is recommended that the sampling and measurement procedure be repeated.

Once the possibility of any error in Fyrite reading has been eliminated, calibrate your Incubator to conform with the reading obtained. It only takes about 5 minutes and will improve incubation protocols and can forewarn of possible Incubator problems before they become serious.

RS232 STATISTICS FOR ALL MODEL INCUBATORS:

DESCRIPTION:

An output from the Incubator is available at all times via the rear panel for RS232 connection to a printer or computer at a FIXED 1200-BAUD RATE. The output consists of TEMPERATURE AND CO_2 data as well as a POWER-OUTAGE confirmation upon power up.

Outputs are present at 1-MINUTE INTERVALS (also fixed). The software will determine whether or not the receiving device expects to use a CTS (Clear- To-Send) protocol or not and will issue data accordingly. CTS is sometimes referred to as the "busy" line and is mostly used by slower devices such as Line Printers. When a Capture program is used to receive data such as in a PC, CTS is generally not used and THE INCUBATOR SOFTWARE WILL COMPLY AUTOMATICALLY.

OPERATION: (Con't)

RS232 STATISTICS FOR 465/495 SERIES INCUBATORS: (Con't)

- The output format used is as follows:

PRINTER (CTS USE): DOUBLE LINE:

⇒ Temp = XXX.X C(LF)(CR) <<Line Feed/Carriage Return
⇒ CO2 = XX.X% (LF)(CR)(LF)(CR)

- Capture Program (PC): Single Line:

⇒ Temp = XXX.X C, CO2 = XX.X% (LF)(CR)

- Upon resumption of power after a power outage or any power-up event: Single Line:

⇒ ...RESUME SYSTEM POWER (LF)(CR)

- The RS232 data pins available at the rear of the unit (D-subminiature 9-pin) are:

⇒ Signal Ground: Pin 5 (To your device ground)
⇒ Transmit (TX): Pin 3 (To your device "Receive data" input)
⇒ CTS (RX): Pin 8 (From your device CTS, RTS or DTR output)

- Characters are transmitted in an 8-bit UART fashion:

⇒ >> 10 bits are transmitted: a start bit (0), 8 data bits (LSB) and a stop bit.
⇒ NO additional parity bits are included and the MSB data bit is always zero.
⇒ >> Meets RS232C and V.24 Electrical Specifications.

POWER MAINS PROTECTION: MODELS 460-1CE, 465-1CE, 490-1CE & 495-1CE

If a fuse blows, have a qualified person replace it with a properly rated fuses—these now follow here: The internal primary of the transformer fuse is: 0.6 AMP, Littlefuse® #313.006, Slo-Blo Type (Lab-Line Part #330-370-00); internal motor lead fuse is: 1 AMP, Littlefuse® #313.001 (Lab-Line Part #330-369-00).

SECTION 7

MAINTENANCE

BE ADVISED:

NOTE: MAKE NO ATTEMPT TO SERVICE OR REPAIR A LAB-LINE PRODUCT UNDER WARRANTY BEFORE CONSULTING YOUR LAB-LINE DEALER. AFTER THE WARRANTY PERIOD, SUCH CONSULTATION IS STILL ADVISED, ESPECIALLY WHEN THE REPAIR MAY BE TECHNICALLY SOPHISTICATED OR DIFFICULT.

IF ASSISTANCE IS NEEDED BEYOND WHAT THE DISTRIBUTOR CAN PROVIDE, PLEASE CALL THE LAB-LINE CUSTOMER RELATIONS DEPARTMENT AT (563) 556-2241 OR (800) 522-5463. NO MERCHANDISE, HOWEVER, SHOULD BE RETURNED DIRECTLY TO LAB-LINE WITHOUT PRIOR APPROVAL FROM LAB-LINE.

CAUTION: DISCONNECT PLUG FROM ELECTRICAL OUTLET BEFORE ATTEMPTING ANY MAINTENANCE OR REPAIR OF THIS UNIT.

CLEANING:

Every 6-months, inspect the chamber. If water is added for humidity, remove any scale accumulation. Clean the stainless steel interior with any good scale remover or dilute acetic acid and a synthetic scouring pad. DO NOT USE chlorine-based cleansers or bleach, scouring pads with metallic content or harsh abrasives to clean any part of the Incubator.

DOUBLE-DOOR CONSTRUCTION WITH INNER DOOR DEFOGGER:

DOOR CANNOT BE REPAIRED, ENTIRE ASSEMBLY MUST BE REPLACED.

CARE AND CLEANING OF STAINLESS STEEL:

CAUTION: DISCONNECT UNIT FROM POWER SOURCE PRIOR TO CLEANING. WE RECOMMEND ALL SERVICE BE PERFORMED BY QUALIFIED SERVICE PERSONNEL.

WARNING: ELECTROLYSIS CAN DAMAGE STAINLESS STEEL. THIS OCCURS WHEN AN OBJECT IS ALLOWED TO REST DIRECTLY ON THE SURFACE OF STAINLESS STEEL, TRAPPING MOISTURE THAT BECOMES OXYGEN-STARVED, BUT IS SURROUNDED BY WATER-CONTAINING OXYGEN.

MAINTENANCE: (Con't)

THE ALLOY CALLED STAINLESS:

Stainless steel is an alloy of steel with chromium and nickel that increase the metal's resistance to rust and corrosion. Yet, if not properly cared , stainless steel can rust and corrode.

Exposure to air provides the passivation, or oxide layer coating, for clean stainless by producing a thin, durable chromium-oxide film that forms rapidly on the alloy surface to give stainless its characteristic “stainless” quality. Also exposure of the surface to other oxidizing environments can produce a passivating film or coating.

However, if free oxygen is not available due to scale or contamination buildup the metal surface may become vulnerable to rusting and corrosion as well as pitting. But by maintaining neutral pH and conducting frequent cleanings with detergent and water, years of trouble-free service from stainless steel products can be obtained.

SOME STAINLESS GUIDELINES TO CONSIDER:

Distilled water is recommended. Please note, if this water is very pure it may be corrosive to stainless. When filling a bath or incubator, ALWAYS ADD 2 to 40 PPM (20 TO 40 MG/LITER) DISODIUM PHOSPHATE OR SODIUM BICARBONATE, ADJUSTING DOSAGE TO PROVIDE A pH VALUE OF 7 TO 9.

If not available, use clean, aerated soft tap water provided the total solids concentration is < 500 PPM.

WE DO NOT RECOMMEND USING 18 MEG OHM DEIONIZED WATER. If this is the only source of treated water available—mix with regular tap water at a 50/50 ratio.

THE pH FACTOR:

Check pH regularly. If pH is <6.0, add disodium phosphate to increase pH to a 7 to 9 value. Sodium carbonate or sodium bicarbonate may be used but they tend to form scale that must be rinsed out regularly. If pH is >10.0, add sodium bisulfate to decrease pH to a 7 to 9 value. Avoid adding harsh alkalines or acids since these may cause localized corrosion and result in unstable pH.

SPECIAL STAINLESS CONSIDERATIONS:

WARNING: IF IT IS NECESSARY TO USE THE FOLLOWING CHEMICALS, LIMIT EXPOSURE TIME TO A MAXIMUM OF 3 HOURS—ALWAYS CLEAN SURFACES IMMEDIATELY AFTER USE.

Chemicals which should be limited to a 3-hour maximum exposure time to stainless steel are:

Aluminum chloride	E.D.T.A.	Potassium permanganate
Barium chloride	Ferrous chloride	Potassium thiocyanate
Calcium chloride	Lysol	Sodium hypochlorite
Chlorinated Lime	Mercury salts	Stannous chloride
Citric acid (boiling)	Phenol	Tartaric acid
Dakin’s solution		

MAINTENANCE: (Con't)

BE ADVISED: NEVER USE THE FOLLOWING ON STAINLESS STEEL:

Aqua regia
Ferric chloride
Iodine
Sodium acid
Sodium azide

Chemical spills, especially those agents listed here, should be removed as soon as possible and the stainless steel surface cleaned with mild soapy water followed by a clean water rinse.

CLEANSING AGENTS:

Anti-fungal and anti-bacterial additives are permissible to use as long as the pH of the aqueous solution is kept within the range of 7 to 9. These are available through laboratory distributors. But, be sure to CONFIRM that they are not harmful to stainless steel.

STAINLESS CLEANING METHODS:

Do not use any metallic pads. Instead, for stubborn stains, use a plastic light-duty cleansing pad and rub GENTLY in the direction of the metal grain.

If stains continue to persist, use one of the following chemicals and methods.

CAUTION: EXTREME CARE MUST BE TAKEN WHEN HANDLING THESE MATERIALS. ALWAYS WORK IN AN AREA WITH ADEQUATE VENTILATION. USE THE PRECAUTIONS AS OUTLINED IN THE *MATERIAL SAFETY DATA SHEET* (MSDS) AND THE MANUFACTURER'S INSTRUCTIONS FOR THE PRODUCT BEING UTILIZED. ALSO, FOLLOW THE PERSONAL PROTECTION INDEX FOUND IN THE *HAZARDOUS MATERIALS INFORMATION SYSTEM* (HMIS) SECTION OF THE *MSDS*.

NOTE: THE USE AND DISPOSAL OF THESE CHEMICALS MAY BE REGULATED BY YOUR LOCAL CITY CODES; CONSULT THOSE REGULATIONS BEFORE OF DISPOSING OF THESE MATERIALS.

- Any of a variety of "scale removers" available at local supermarkets or hardware stores used for the cleaning of coffee marks, humidifiers or vaporizers.

- A 15% to 35% phosphoric acid solution available from laboratory supply distributors for scale and rust removal. Allow solution to soak the surface affected until rust and scale is loosened. Immediately follow with a clean water rise.

MAINTENANCE: (Con't)

STAINLESS CLEANING METHODS: (Con't)

- Citric acid based cleaners.
- Bathroom tub and tile cleaners.
- A mixture of 20% nitric acid and 1.5% hydrofluoric acid (or hyrochloric acid). Swab solution on surface allowing it to remain until rust is loosened. Immediately follow with a clean water rise. This method should ONLY be used if SEVERE rust and scale stains are present.
- Oxalic acid 2% to 5% in warm water. Swab solution on surface allowing it to remain until rust is loosened. Immediately follow with a clean water rise. This method should ONLY be used if SEVERE rust and scale stains are present.

  Regardless of the approach utilized, ALWAYS follow the manufacturer's directions and allow the chemicals to do the cleaning with MINIMAL scrubbing. Always follow cleanings with a clean water rinse. Air dry.

MATERIALS EFFECTIVE IN DISINFECTING STAINLESS:

- Glutaraldehyde
- Alcohol

BE ADVISED: THIS INFORMATION IS INTENDED AS **GUIDELINES ONLY** AND LAB-LINE INSTRUMENTS, INC. MAKES NO CLAIM AS TO THE SUITABILITY TO ANY PARTICULAR SITUATION. CONSULT YOUR STAFF CHEMIST TO DETERMINE WHAT WOULD BE BEST FOR YOUR STAINLESS STEEL PRODUCT AND LABORATORY.

UNIT REPAIRS:

In the event that your unit becomes inoperative, consult with your local dealer for assistance.

REPLACEMENT PARTS

120 VAC INCUBATORS (WITH PLUG):

DESCRIPTION	PART NUMBER
Axial Fan:	160-136-00
Blower Motor:	370-278-00
Circuit Breaker, 5 Amp:	330-118-00
Circuit Breaker, 10 Amp:	330-119-00
Fuse, 1 Amp:	330-369-00
Cordset:	470-311-00
Foot, Leveling:	790-401-00
Gasket, Outer Door:	530-246-00
Gasket, Glass Door:	530-258-00
Heater, Outer Door:	340-351-01
Printed Circuit Board Assembly:	
460:	018-476-00
465:	018-477-00
490:	018-474-00
495:	018-475-00
460RH:	018-476-00
465RH:	018-477-00
490RH:	018-474-00
495RH:	018-475-00
RTD Sensor:	410-632-00
Shelves (5):	593-108-00
Solenoid Valve:	950-135-00
Strain Relief:	380-571-00
Switch, Door:	440-080-00
Switch, Power:	440-359-00
Thermostat, High Limit:	920-301-00
Tube Heater:	340-356-01
Door Strain Relief:	380-081-00
Blower Wheel:	160-184-01
Control Panel Keyboard:	
460, 465, 490, 495:	682-285-00
460RH, 465RH, 490RH, 495RH:	682-566-00
CO2 Sensor:	017-924-00
Humidity Sensor:	410-659-00
Wiring Schematic, Model 465:	228-553-19
Wiring Schematic, Model 495:	228-553-15
Wiring Schematic, Model 460:	228-553-17
Wiring Schematic, Model 490:	228-553-13

REPLACEMENT PARTS: (Con't)

240 VAC INCUBATORS (WITHOUT PLUG):

DESCRIPTION	PART NUMBER
Axial Fan:	160-136-00
Blower Motor:	370-279-00
Circuit Breaker, 10 Amp:	330-119-00
Fuse, 1 Amp:	330-369-00
Cordset:	470-311-00
Foot, Leveling:	790-401-00
Gasket, Outer Door:	530-246-00
Gasket, Glass Door:	530-258-00
Heater, Back & Bottom:	340-350-01
Printed Circuit Board Assembly:	
460:	018-476-00
465:	018-477-00
490:	018-474-00
495:	018-475-00
460RH:	018-476-00
465RH:	018-477-00
490RH:	018-474-00
495RH, 495-1RH:	018-475-00
RTD Sensor:	410-632-00
Shelves (5):	593-108-00
Solenoid Valve:	950-135-00
Strain Relief:	380-571-00
Switch, Door:	440-080-00
Switch, Power:	440-292-00
Thermostat, High Limit:	920-301-00
Tube Heater:	340-356-01
Door Strain Relief:	380-081-00
Blower Wheel:	160-184-01
Control Panel Keyboard:	
460, 465, 490, 495:	682-285-00
460RH, 465RH, 490RH, 495RH:	682-566-00
495-1RH:	682-670-00
CO2 Sensor:	017-924-00
Humidity Sensor:	410-659-00
Wiring Schematic, Model 460-1CE:	228-553-18
Wiring Schematic, Model 490-1CE:	228-553-14
Wiring Schematic, Model 465-1CE:	228-553-11
Wiring Schematic, Model 495-1CE:	228-553-35
Wiring Schematic, Model 495-1RH:	229-305-00

NEED A PART? CALL THE LAB-LINE PARTS HOTLINE.
CALL (563) 556-2241 or (800) 522-5463; FAX (563) 589-0516.

WARRANTY

LAB-LINE INSTRUMENTS, INC. (“Lab-Line”) warrants that the product manufactured by Lab-Line shall be free of defects in materials and workmanship for a period of time defined on the following page from the first to occur of (i) the date the product is sold by Lab-Line or (ii) the date the product is purchased by the original retail customer (the “Commencement Date”). Except as expressly stated above,

LAB-LINE MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, WITH RESPECT TO THE PRODUCTS AND EXPRESSLY DISCLAIMS ANY AND ALL WARRANTIES, INCLUDING BUT NOT LIMITED TO, WARRANTIES OF DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

An authorized representative of Lab-Line must perform all warranty inspections. In the event of a defect covered by Lab-Line’s warranty, Lab-Line shall, as its sole obligation and exclusive remedy, provide free replacement parts to remedy the defective product. In addition, for products sold by Lab-Line within the continental United States or Canada, Lab-Line shall provide free labor to repair the products with the replacement parts, but only for a period of ninety (90) days from the Commencement Date.

Lab-Line’s warranty provided hereunder shall be null and void and without further force or effect if there is any (i) repair made to the product by a party other than Lab-Line or its duly authorized service representative, (ii) misuse (including use inconsistent with written operating instructions for the product), mishandling, contamination, overheating, modification or alteration of the product by any customer or third party or (iii) use of replacement parts that are obtained from a party who is not an authorized dealer of Lab-Line.

IN NO EVENT SHALL LAB-LINE BE LIABLE TO ANY PARTY FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, OR FOR ANY DAMAGES RESULTING FROM LOSS OF USE OR PROFITS, ANTICIPATED OR OTHERWISE, ARISING OUT OF OR IN CONNECTION WITH THE SALE, USE OR PERFORMANCE OF ANY PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, TORT (INCLUDING NEGLIGENCE), ANY THEORY OF STRICT LIABILITY OR REGULATORY ACTION.

The name of your nearest authorized Lab-Line dealer may be obtained by calling 1-800-522-5463.

DESIGNERS AND MANUFACTURERS
A SUBSIDIARY of Barnstead|Thermolyne
1999 North 15th Ave., Melrose Park, IL 60160-1491 USA
PHONE: (563) 556-2241 or (800) 522-5463; FAX: (563) 589-0516

WARRANTY

12 MONTH PARTS WARRANTY:

- All Environmental Chambers
- Low Temperature B. O. D. Incubators
- Animal Study Chamber
- Controlled Environment Centers
- Biological Work Station
- Refrigerators, Freezers
- Chromatography Refrigerators (5 year parts warranty on compressor only)
- Large Capacity Refrigerators and Freezers (5 year parts warranty on compressor only)

24 MONTH PARTS WARRANTY:

- Frame Clamps, Frame Sets, Lab Jacks
- Saybolt Viscosimeter
- Timers, Samplers, Flasks
- Saf-T-Shield, Safety Tongs
- All Incubators & Ovens
- Dual Action Open Air Shaker
- Reciprocating Shakers (open air and water bath)
- Rockers and Rotators
- Low Cost Shakers
- Environ Blok Shaker
- Titer Plate Shaker
- Multi Wrist Shaker
- Water Baths (excluding Aquabaths), Ultrasonic Cleaners
- Slide Warmers
- Mixers, Stirrers, Hotplates
- Thermal Cyclers
- Blok Heaters
- Aquabaths, lifetime warranty on heaters

LIFETIME PARTS WARRANTY:

- All **ORBITAL** Shakers (not carrying a 24 month parts warranty) offer a lifetime parts warranty on the drive mechanism and a 5 year warranty on all other parts
- Refrigerated Orbital Shakers carry a lifetime warranty on the drive mechanism, 1 year parts warranty on the compressor, and a 5 year warranty on all other parts.

FIRST IN INSTRUMENTS SERVICING SCIENCE, INDUSTRY, RESEARCH AND EDUCATION
SINCE 1908.

ACCESSORY CHECKLIST

The following loose parts and accessories are packed with this unit. Before discarding any packing materials, please be sure that nothing has been overlooked.

MODEL NO: 460, 460JPN, 460RH, 460-1, 460-1CE, 462, 462-1, 462-1CE, 464, 464-1, 464-1CE, 465, 465RH, 465-1, 467, 467-1, 469, 469-1, 490, 490RH, 490-1, 490-1CE, 492, 492-1, 492-1CE, 494, 494-1, 494-1CE, 495, 495JPN, 495RH, 495-1, 495-1rh, 497, 497-1, 499, 499-1, 391, 391-1, 391-2, 391-3

CHECKED BY: _____

DATE _____

PACKED BY _____

CHECKED	ITEM	PART NUMBER	QUANTITY
_____	Shelves	593-108-00	5
_____	Shelf Support Side Panels	019-451-00	2
_____	Gas Filter Interface Assy*	018-514-00	1
_____	Hose Barb Quick Connect Plug (460 Series)	950-170-00	2
_____	Operation Manual	057-588-00	1
_____	Warranty Card	528-022-00	1
_____	Voltage Warning Tag (240 Volt)	528-009-00	1
_____	Locking Grommet	790-327-00	2
_____	Port Stopper	875-118-00	1
_____	Humidity Pan	018-637-00	1
_____	Rear Cover Panel	019-373-00	1
_____	Top Plenum	019-350-00	1

*Assy Includes 10’ PVC tubing #720-418-00