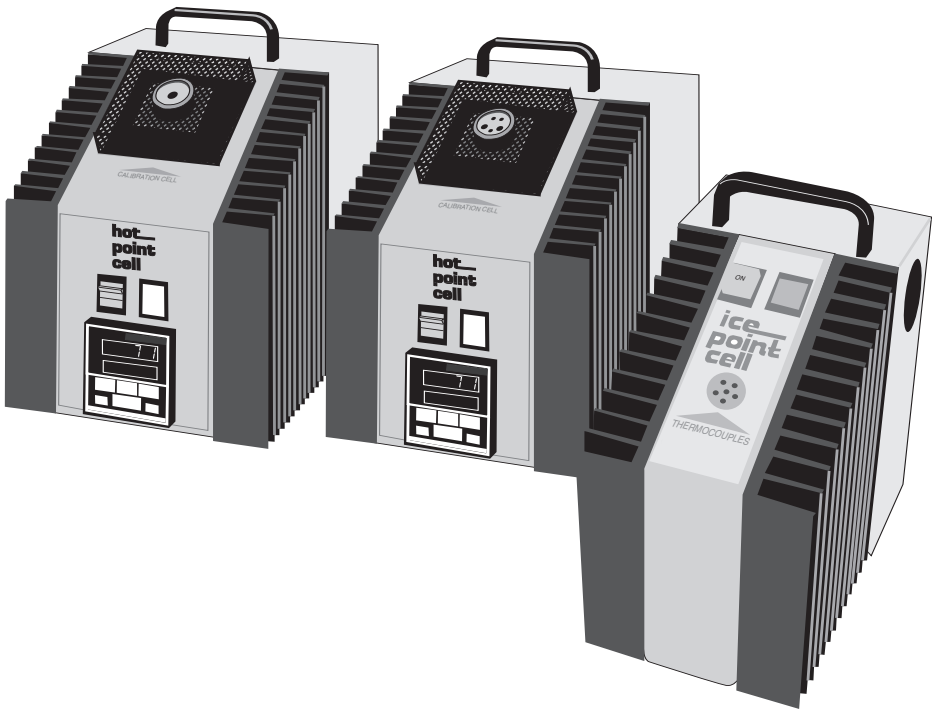
1 YEAR
WARRANTY

User's Guide



CL900 AND CL950
hot point® Calibrators and TRCIII
ice point™ Reference Cell

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CL900 & CL950 hot point CALIBRATOR

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SECTION 1 INTRODUCTION

1.1 DESCRIPTION

OMEGA's hot point® Calibrator is a portable, solid state controlled instrument designed for easy on-site calibration of temperature sensors. The hot point Calibrator is designed for portability, low cost, and ease of operation. When used properly, the instrument will continue to provide accurate calibration of temperature probes and sensors including thermocouple, RTD and thermistor probes.

The following models are available:

MODEL NO.	FEATURES
CL900 -110 -220	Removable single port well insert
CL950 -110 -220	Built-in multiport well

- The dual LED front panel display provides a clear view of both the block and setpoint temperatures.
- You can easily set any temperature within the unit's operating range using the front keypad.
- A precision platinum RTD sensor controls the calibrator's block temperature.
- The calibrator's over-temperature multiple fault protection devices ensure both user and instrument safety and protection.

To take full advantage of the calibrator's many features, be sure to read the operating procedures in Section 5 of this manual.

1.2 TECHNICAL OVERVIEW

- The hot point Calibrator features an aluminum-bronze block, which is uniformly heated by four strategically located heaters.
- A powerful microprocessor-based digital PID auto-tune temperature controller regulates the temperature.
- The calibrator is ready for use; optimum control parameters have been factory programmed into the temperature controlling device. However, if you wish to fine tune the calibrator for a particular operation, you may auto-tune the PID parameters. Refer to Section 6, Auto-tuning the Calibrator.

MODEL NO.	WELL	PORTS	AVAILABLE INSERTS
CL900	Removable well insert Depth: 6" (153 mm)	1 port	Well diameter: 1/8", 3/16", 1/4", 5/16", 3/8", undrilled (solid)
CL950	Built-in well Depth: 6" (153 mm)	5 ports: Diameter: 1/16", 1/8", 3/16", (2) 1/4"	None

1.2.1 CL900

The CL900 has a 6" (153 mm) deep test well which accepts a variety of optional inserts. These inserts are sized to provide the best thermal contact with the test probe.

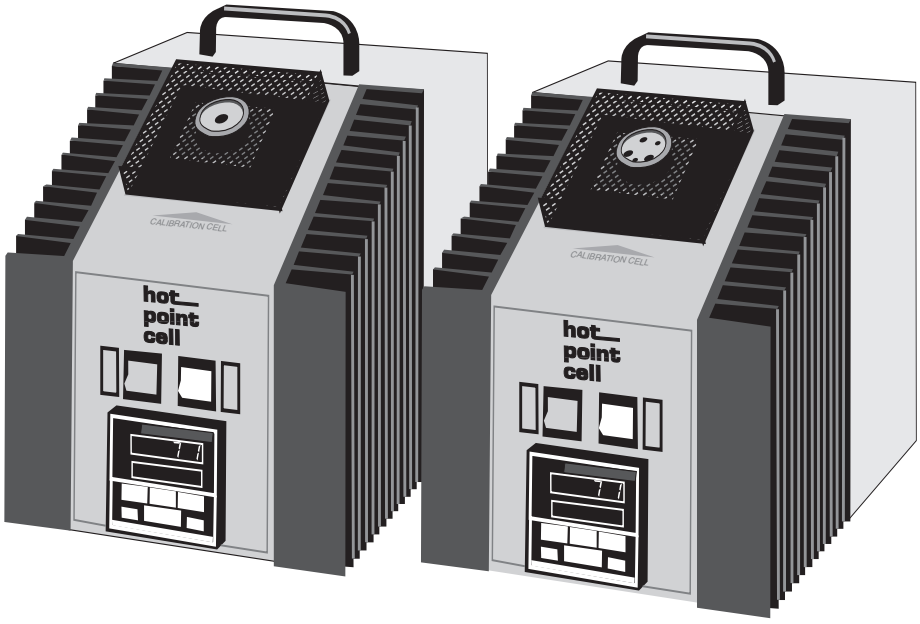
- The CL900 is shipped with an insert having a 1/4" diameter well 6" deep.
- Optional inserts are available with 4" and 6" depths, for 1/8", 3/16", 1/4", 5/16" and 3/8" probe diameters (see Section 9.4.3 for part numbers).
- An undrilled insert is also available, which can be drilled to the required well diameter.

Order additional inserts separately as required for other diameter probes. For all probes over 7" long, 6" depth wells are the best choice. See Section 9.4 for part numbers.

1.2.2 CL950

The CL950 has a 6" (153 mm) deep built-in test well which accommodates 1/16", 1/8", 3/16", and two 1/4" temperature probes. The multiport design allows you to:

- Calibrate more than one probe at a time.
- Use a pre-calibrated (or NIST traceable) probe and meter as a standard while calibrating other probes.



CL900 **CL950**

Figure 1-1. CL900 & CL950 hot point Calibrators

SECTION 2 UNPACKING

Remove the Packing List and verify that you have received all equipment. If you have any questions about the shipment, please call the OMEGA Customer Service Department.

When you receive the shipment, inspect the container and equipment for any signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

Check the shipping box to be sure you have received the following items:

CL900	CL950
CL900-110 or CL900-220 Calibrator CL906 Insert: (1/4" diameter x 6" depth well) Insert block tongs Magnetized reference card Operator's manual	CL950 Calibrator Magnetized reference card Operator's manual

SECTION 3 SAFETY

WARNING

- **NEVER touch the heated calibrator or probes without proper protection.**
- **NEVER place any object (other than the CL900 insert) into the CL900 block.**
- **NEVER use a voltage other than that for which your unit is rated. Use only a 50/60 Hz grounded outlet.**
- **NEVER replace either of the fuses with one of a current rating greater than the original.**
- **NEVER unplug the heated calibrator until it has cooled down to under 300°F (149°C).**
- **NEVER set objects on top of the calibrator.**

CAUTION

- **DO NOT** use the calibrator in excessively dusty or dirty environments or near liquids.
- **DO NOT** attempt to alter the programmed constants (other than the PID parameters discussed in Section 6.2).
- **DO NOT** turn off the power switch until the heated calibrator has cooled down to under 300°F (149°C).

NOTE

- **ALWAYS** use the special tongs provided with the CL900 to remove the insert.
- **ALWAYS** follow the proper procedure for cooling down the calibrator (below).

COOL-DOWN PROCEDURE

- **KEEP THE CL900 PLUGGED IN WITH THE POWER SWITCH ON DURING COOL-DOWN, SO THAT THE COOLING FAN WILL OPERATE CONTINUOUSLY.**

1. **Change the setpoint to 300°F (149°C) or lower, and allow the unit to cool down to this temperature. When the CL900 has been operating in the 800°F to 900°F (427°C to 482°C) range, it will take approximately one hour and 15 minutes to cool down to 300°F (149°C).**

2. **You may unplug the unit without causing damage when it reaches 300°F (149°C). If you turn off the power switch before reaching 300°F (149°C), the cooling fan will still operate intermittently. This allows the unit to cool down safely. However, when the CL900 has been operating at 900°F (482°C) and the power switch is turned off, cooling down to 300°F (149°C) can take as long as two hours.**

- **DO NOT UNPLUG THE CL900 WITH THE TEMPERATURE ABOVE 300°F (149°C) OR SEVERE DAMAGE MAY OCCUR.**

- Operate the calibrator at room temperatures between 40°F and 100°F (5°C and 38°C).

- Leave at least 9" of space between the rear of the calibrator and nearby objects for air circulation. Keep the area around the instrument neat and clean. Position the calibrator as shown in Figure 3-1.

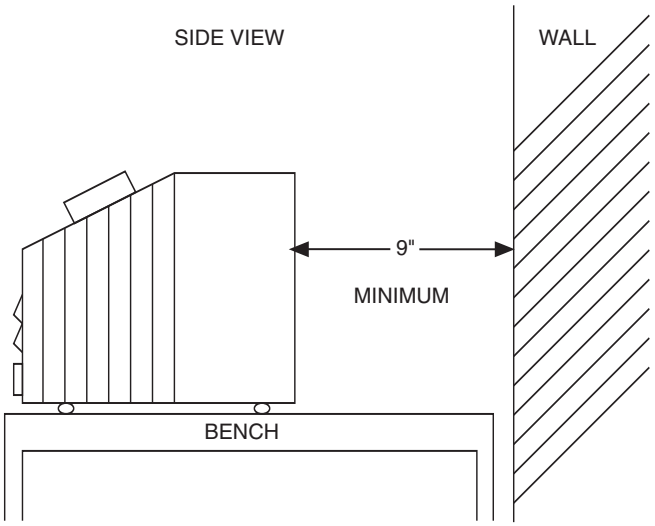


Figure 3-1. hot point Calibrator Location

- The calibrator is a precision instrument. Although it has been designed for optimum durability and trouble-free operation, it must be handled with care.

- The calibrator generates very high temperatures. Probes can be very hot when removed from the well. Take precautions to prevent personal injury or damage to objects in the area.

- Allow the block to cool before exchanging CL900 inserts (see Section 7). Use the special tongs that are supplied with the CL900 to remove the insert. Never place anything (other than one of the CL900 inserts) into the CL900 block.

- Keep the calibrator connected to a live power source during the cooling period. If the power switch is turned off while the calibrator is still warm, the thermal sensor will automatically activate the cooling fan to insure a proper cool-down. DO NOT unplug the calibrator while it is still above 300°F (149°C); this may cause irreversible damage to the unit.

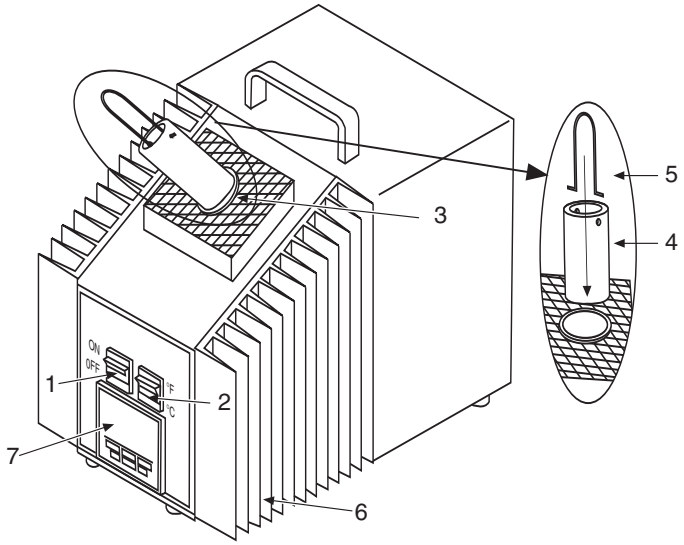
- The calibrator is equipped with two fuses, the fan fuse and load fuse.
    - If either fuse should blow, first replace the defective fuse. Never replace either of the fuses with one of a current rating greater than the original.
    - If the fuse blows repeatedly, there is probably a problem with a component in the calibrator. In this case, contact the OMEGA Customer Service Department. To replace either fuse, unplug the calibrator. If the unit is hot, restore power to the fan as quickly as possible to prevent internal damage. See Section 9.1 for more details.

- The hot point Calibrator is pre-programmed and factory calibrated for optimum performance. The auto-tune function is available (refer to Section 6.1) for fine-tuning the factory preset parameters.

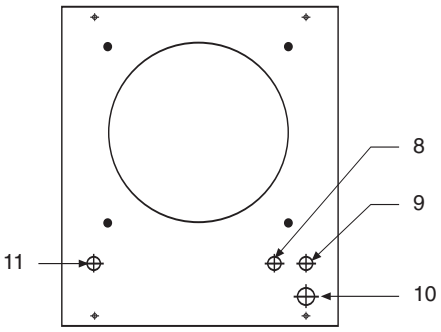
- The calibrator cannot be field-calibrated. If you suspect that the unit is out of calibration or in need of repair, contact OMEGA for assistance. Do not attempt to alter the programmed constants (other than the PID parameters as discussed in Section 6.2).

- Two thermal sensors provide over-temperature protection for the hot point Calibrator. These sensors are strategically located on the calibrator's block cooling jacket. If the temperature exceeds normal limits, these sensors turn off power to the heaters. Both sensors reset automatically when operating conditions return to normal.

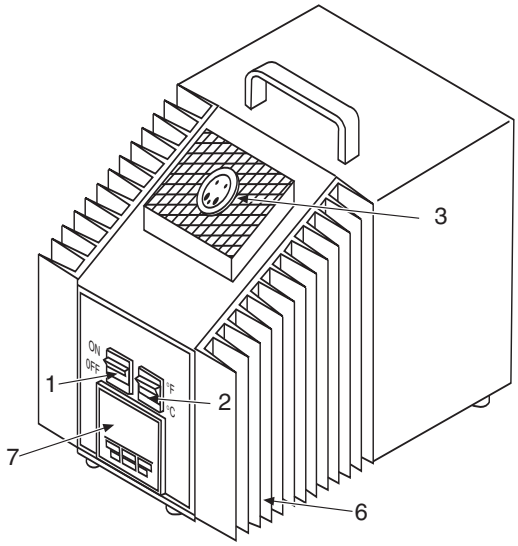
SECTION 4 PARTS OF THE CALIBRATOR



CL900



Back of Calibrator



CL950

Figure 4-1. CL900 & CL950 Calibrator Parts

TABLE 4-1
CALIBRATOR PARTS & ACCESSORIES

KEY	LABEL	DESCRIPTION
1	**POWER SWITCH**	The switch has 2 positions labelled ON and OFF. Use ON for normal operation. OFF disconnects power to the entire unit with the exception of the cooling fan circuit.
2	**°F / °C SWITCH**	The switch is located on the front panel of the calibrator to the right of the power switch. It has 2 positions labelled °F and °C. Set this switch before turning the calibrator on. DO NOT change the °F/°C switch during the calibration process. If changed, it resets your set-point value to 0.
3	**STABILIZING BLOCK**	Made from aluminum bronze, specifically designed to be heated and controlled to precise preset temperatures. The stabilizing block is located directly under the screen on the top sloped surface of the calibrator. The stabilizing block allows various types and sizes of temperature sensors to be inserted for calibration.The CL900 stabilizing block has removable inserts.
4	**INSERT**	CL900 ONLY: Made from aluminum bronze in a cylindrical form. Designed to be inserted into the stabilizing block through an opening in the top of the calibrator. The insert has a hole at one end (called the well) with a diameter and depth chosen to accept the size of the sensor being calibrated. Refer to Section 9.4 for the types of inserts available.
5	**INSERT BLOCK TONGS**	CL900 ONLY: Designed for gripping the top end of the insert (which has two diagonally-placed holes) to remove it from the stabilizing block.
6	**HEAT SINK**	Consists of a dual set of aluminum fins which thermally support the discharge of excess heat from within the calibrator.
7	**DISPLAY PANEL**	A microprocessor-based PID Auto-tune dual display controller. Refer to Table 4-2 and Figure 4-2 for additional information.
8	**FAN FUSE**	Controls the fan circuit only. The fuse has a fast blow, 3AG, 1/8A, 250V rating.
9	**LOAD FUSE**	Controls all circuitry with the exception of the fan circuit. The fuse has a fast blow, 3AG, 10A, 250V rating.
10	**POWER CORD**	Use only the voltage for which your unit is rated. Use only a 50/60 Hz grounded outlet.
11	**AUXILIARY JACK**	Reserved for future use.

TABLE 4-2
CALIBRATOR DISPLAY & CONTROLS

To set the setpoint, press the "membrane keys" on the front panel of the calibrator with your finger. DO NOT use any sharp or pointed objects, which may cause permanent damage to the instrument's keypads.

KEY	SYMBOL*	DESCRIPTION
1 **RED LED DISPLAY**		The top numeric LED (red) display reads the actual calibration well temperature.
2 **GREEN LED DISPLAY**		The bottom numeric LED (green) display reads the setpoint temperature.
3 **UP KEY**	▲	Used to increase the setpoint temperature setting.
4 **DOWN KEY**	▼	Used to decrease the setpoint temperature setting.
5 **BLANK KEY**		Used with the Parameter Selector Key for resetting the factory-set parameters
6 **ENT KEY**	**ENT**	Used to lock in the newly entered setpoint and to start the heating process.
7 **AT KEY (AUTO-TUNE)**	**AT**	Use this key ONLY if you want to automatically tune (AUTO-TUNE) the PID parameters (refer to Section 6.1). The controller is already preset for optimum operation, and should not need to be altered for most operations.
8 **PARAMETER SELECTOR KEY**	↻	When you press the Parameter Selector key, a parameter character will appear in the Parameter Window (9). This will not affect calibrator operation. Within 60 seconds, the parameter character will automatically revert to its normal display: 5
9 **PARAMETER WINDOW**		The area where the parameters you select (using the Parameter Selector Key) are displayed.
10 **CONTROL LED (GREEN)**		This LED indicates that there is power to the (GREEN) stabilizing block heaters. The LED and heaters cycle with a one (1) second cycle time.
11 **AT LED**		When continuously lit, indicates that the AT (AUTO-TUNE) key has been pressed; when flashing, indicates unit is in the AT mode; when unlit, indicates unit is no longer in AT mode. Refer to Section 6.1.
* = See Figure 4-2.		

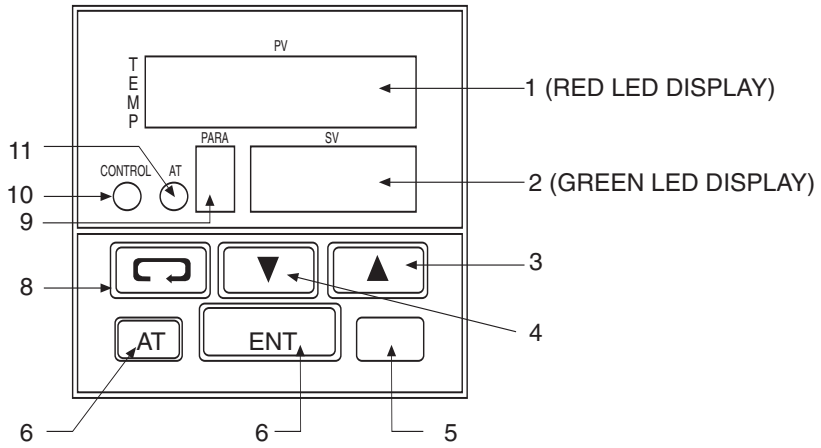


Figure 4-2. CL900 & CL950 Display Panel Controls and Indicators

SECTION 5 OPERATING PROCEDURES

CAUTION

- Operate the calibrator at room temperatures between 40° and 100°F (4.4° and 37.7°C).
- Always use the calibrator in an area with adequate ventilation, where the air can move freely around the unit.
- Allow ample clearance (at least 9" at the back of the unit for the stabilizing and cooling air to exhaust).
- Do not place the calibrator near objects subject to heat damage.

5.1 BEFORE TURNING THE CALIBRATOR ON

1. Make sure that the power switch is in the OFF position.
2. Trial fit the temperature probe that you want to calibrate in the insert test well to determine if you have selected the right size. The probe should fit snugly inside the test well for good thermal contact. In order to maintain stated accuracies, the sensing portion of the test probe must make good contact with the bottom of the test well.

   2a. Use probes 5" or longer in the 4" test well, and probes 7" or longer in the 6" test well. The additional probe length will:
   - Ensure that the probe reaches the bottom of the well
   - Protect any connectors, junctions, etc., from heat damage or thermal gradients

   2b. The calibration process is more accurate using the 6" test well for long probes.
3. Check to see that the insert is seated properly in the stabilizing block.
4. Determine whether you are going to test probes in °F or °C. Set the temperature selector switch to °F or °C. Refer to Figure 5-1.

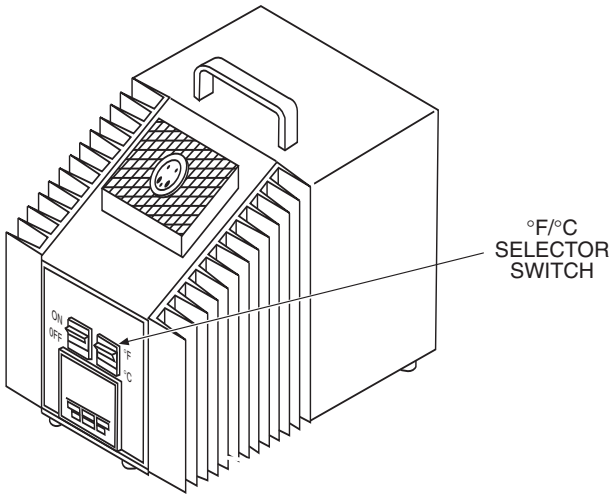


Figure 5-1. °F/°C Temperature Selector Switch Location

5. Connect the probe being calibrated to the readout device (meter, controller etc.).
6. Make sure that the top screen of the calibrator is clear so that airflow will not be restricted.
7. Plug the calibrator into a properly grounded outlet.

5.2 USING THE CALIBRATOR

1. Check to be sure you have completed the steps in Section 5.1.
2. Turn the calibrator ON. You will hear the fan operating.
3. Wait for the PARA window (Figure 5-2) on the calibrator to show 5 (setpoint).

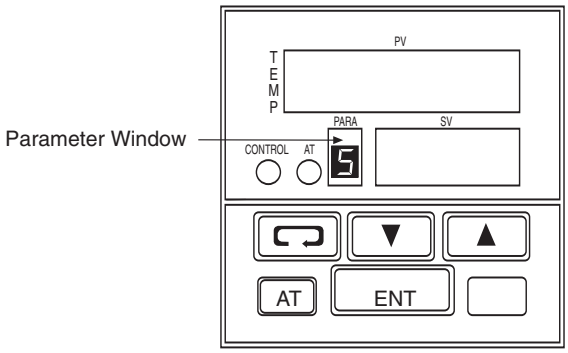


Figure 5-2. Front Panel

4. Select the desired temperature setpoint on the calibrator display.
   - 4a. Use the ▲ or ▼ key on the front of the display to enter the new temperature setpoint value. The decimal point at the lower right corner of the display will flash while the setpoint is being changed. The unit will begin heating the calibrating block to the temperature set on the setpoint display.
   - 4b. **Press the ENT key on the temperature display panel within the next 60 seconds** to store the new setpoint value in memory. At this point, the decimal point will stop flashing.
5. For best results, wait approximately 15 minutes after the calibration block reaches the setpoint to allow the internal temperature of the calibrator to stabilize.
   - 5a. The setpoint temperature appears on the green display.
   - 5b. The actual temperature of the well appears on the red display.
   - 5c. The temperature indicated on the red temperature display is your reference temperature for calibration.
6. You are now ready to calibrate your probes.To determine probe accuracy, compare the reference temperature displayed by the calibrator (red display) with that shown on the probe readout device.

CAUTION
Handle the hot probes carefully.

OPERATING TIPS

- When using the CL900 to test more than one probe, group all the probes that require the same insert size (i.e., all 1/8" diameter probes together, all 3/16" diameter probes together, etc.). Otherwise, you must wait for the calibrator to cool, change the insert, then reheat the calibrator for the next probe.
- When calibrating probes at several setpoints, start at the lowest temperature and work up to higher temperatures. Do not jump back and forth between a very high temperature setting and a relatively cool setting. This will eliminate waiting time for the calibrator to cool down and re-stabilize.
- **If you decide to change from °F to °C (or vice versa) after turning the calibrator on, the setpoint will reset to zero. You must re-select the desired setpoint** (refer to Step 4). Allow time for the temperature to stabilize before proceeding with calibration.

7. After calibrating each probe, remove it from the test well and place it in a safe area for cooling. If you have another probe to test, insert it in the test well, set the setpoint on the calibrator display panel and wait for the temperature to stabilize (refer to Section 5.2, Steps 4 and 5). Compare the reference temperature on the calibrator with the temperature of the probe being calibrated. Repeat for each subsequent probe.
8. **COOL-DOWN PROCEDURE:** After you have calibrated the last probe, adjust the setpoint value to 300°F (149°C) or lower and press the ENT key (refer to Section 5.2, Step 4). After the calibrator has cooled down to this temperature, turn off the power switch and unplug the unit (if necessary).

SECTION 6 AUTO-TUNING THE CALIBRATOR

6.1 USING AUTO-TUNE MODE

"Auto-tune mode" allows you to choose the most effective PID values to achieve minimum temperature variation at a particular setpoint and load. You can engage auto-tune mode at any specific setpoint value within the operating range of the calibrator. However, experience has shown it to be most valuable at temperatures above 450°F (232°C). Refer to Figure 5-2 while performing the following procedures.

To enter auto-tune mode:

1. Press the AT key. The AT LED lights up.
2. Press the ENT key. The AT LED flashes.
   The instrument is now in auto-tune mode.
3. When auto-tuning is complete, the AT LED is no longer lit.

To cancel the auto-tuning function before it completes its cycle:

1. Press the AT key. The AT LED flashes rapidly.
2. Press the ENT key. The AT LED is unlit.

NOTE

Auto-tune mode will be automatically canceled if:

- Power fails during auto-tuning
- 0% or 100% output continues for more than 4-1/2 hours after auto-tuning is started

6.2 RESTORING THE FACTORY-SET PARAMETERS

Follow this procedure if you have engaged the calibrator's autotune function but then wish to restore the calibrator's factory set PID values.

The "parameter" value which appears in the calibrator's parameter window is an adjustable control function. Parameters used by the calibrator include P (proportional), I (integral) and D (derivative). Change **ONLY** the PID values. **DO NOT** change any other parameter values. If any other values have been changed, refer to the table in this section and the troubleshooting guide (if necessary).

Refer to the Parameter Block Diagram (shown in Figure 6-1) while reading the following steps:

NOTE

Use your finger to press membrane keys. Using objects that are sharp, hard, or pointed may cause permanent damage to the keypads.

1. Set each of the 3 parameters (P, I and D) to the factory settings shown below. These are the only parameters you need to change.

FACTORY-SET PID PARAMETERS	
Proportional Band:	2.2%
Integral Time:	105 seconds
Derivative Time:	14 seconds

2. Press the Parameter Key (P) on the keypad. The next parameter appears in the Parameter Window (9).
   2a. This parameter corresponds to the first value in the Parameter Block Diagram.
   2b. Follow the diagram from left to right while using the Parameter (P) key to step through the process.
3. Use the ▲ and ▼ keys to set the desired numerical value. The decimal point in the lower right corner of the green display flashes.
4. Press the ENT key to enter the value. The decimal point stops flashing.

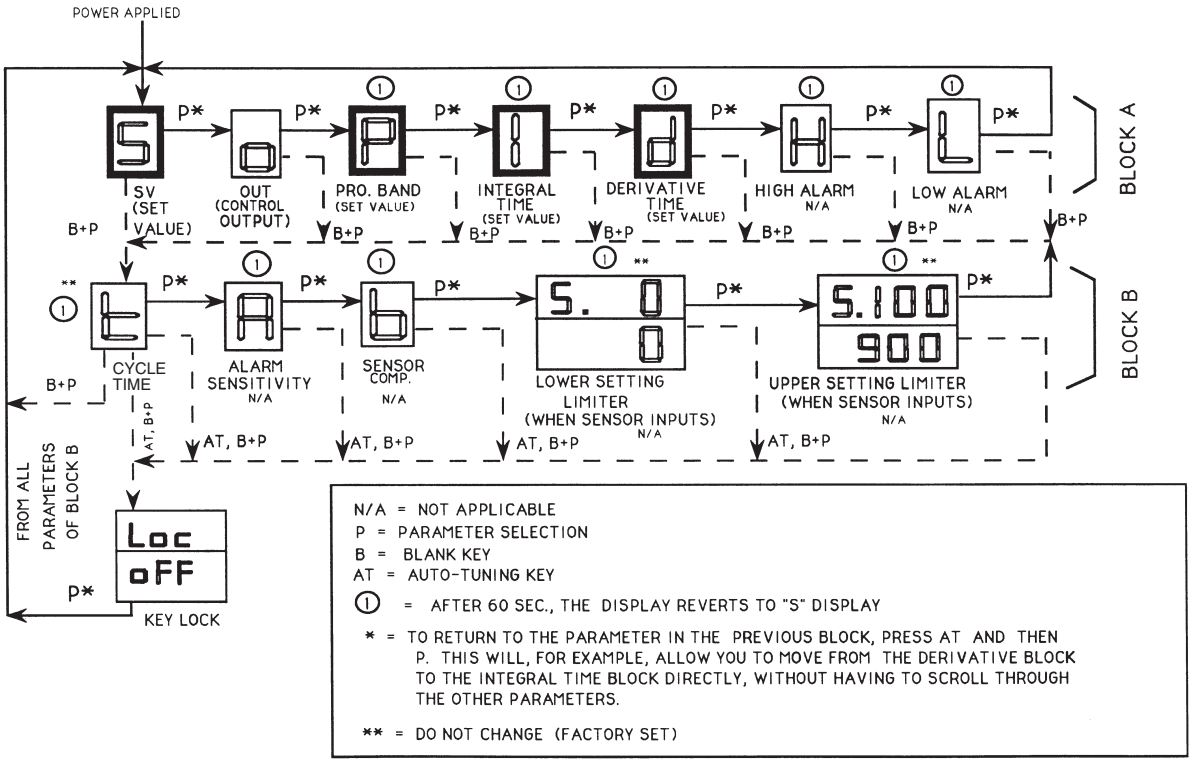


Figure 6-1. Parameter Block Diagram

Change only the parameters with a bold box around them.

6.3 SETTING (OR RE-SETTING) THE KEY LOCK

The calibrator has two key lock states: ON1 and ON2:

ON1	NO CHANGES, including auto-tune, can be made.
ON2	You can change the set-point, and start and stop the auto-tuning process. No other setting changes can be made.

- The calibrator is preset with the key lock in the ON2 state.
- The key lock function is automatically turned off if you engage auto-tune mode. If you then decide to reset the calibrator to the factory set PID values, reset the key lock to the ON2 state.

Follow the steps below to set (or re-set) the key lock. Refer to Figures 6-1 and 4.2 as required.

1. The key lock setting is on the "third level" of the Parameter Block Diagram. Press the B (Blank) key and P (Parameter Selection) keys simultaneously to move to Block B. The Parameter window displays "t".
2. Press the AT key. The AT LED lights up.
3. Press the B (Blank) and P (Parameter Selection) keys simultaneously. The green display shows "oFF".
4. To set the key lock to the ON2 state, use the ▼ key to enter "-5 (minus 5)". Press the ENT key. The display shows "on2".
5. If you want the ON1 state (rather than ON2), press the ENT key. The display shows "on1".
6. To unlock either key lock state (ON1 or ON2), use the ▲ key to enter "5". Press the ENT key. The display shows "oFF".
7. To leave this function, press the P (Parameter) key. The display shows  .

SECTION 7 CHANGING THE INSERT (CL900 ONLY)

To change the insert:

1. Allow the calibrator to cool to room temperature. See Section 3 for the Cool-down Procedure.
2. Place the tong points in the two holes and lift the insert out of the stabilizing block.
3. Put a new insert in the block, making sure it touches the bottom.
4. Reheat the insert to the desired temperature (see Section 5).

SECTION 8 SOLID INSERT DRILLING INFORMATION (CL911 ONLY)

Have a qualified machinist drill the insert to the desired hole diameter with the correct tolerance and depth. The hole diameter should allow the test probe to be readily inserted with the minimum amount of clearance (1/64").

SECTION 9 TROUBLESHOOTING GUIDE

9.1 REPLACING THE FUSE

The fuse for the fan is a 3AG fast blow type with a 1/8A, 250V rating. The main load fuse is a 3AG fast blow type with a 10A, 250V rating. Usually a blown fuse indicates a defective component within the calibrator. Try replacing the fuse first; if it blows repeatedly, there probably is a defective component. Call OMEGA for instructions.

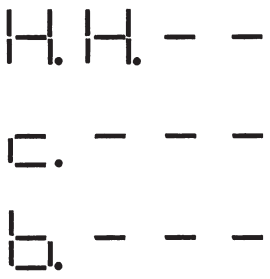
1. Turn off the calibrator and unplug it from the wall outlet.

CAUTION
If the unit is very hot, restore power to the cooling fan as soon as possible. Otherwise, serious internal damage may occur to the calibrator.

2. Unscrew the fuse cap and remove the blown fuse.
3 Insert a new fuse of the same type and current rating, and replace the fuse cap.
4. Plug the calibrator into the wall outlet.
5. Turn the calibrator ON using the ON/OFF switch.

9.2 ERROR MESSAGES

The following messages may appear on the calibrator display. These error messages indicate that the temperature sensor is defective. If you see these messages, contact the OMEGA Customer Service Department.



9.3 FACTORY SET CONTROLLER PARAMETERS

If you suspect that the parameter values have been changed by a previous user, check Table 9-1 for the factory set values. If these values have been changed, you will need to restore them to ensure proper calibrator operation. To reset the factory set parameters, refer to the Parameter Block Diagram and the instructions in Section 6.2.

TABLE 9-1
FACTORY SET VALUES

PARAMETER ABBREVIATION	FACTORY SET VALUE
S	Variable setpoint (user set)
o	Can be viewed only
P	Varies if using Auto-tuning (otherwise it is 2.2%)
I	Varies if using Auto-tuning (otherwise it is 105 sec)
d	Varies if using Auto-tuning (otherwise it is 14 sec)
H	Not applicable
L	Not applicable
t	1 second (DO NOT ADJUST)
a	Not applicable
b	Factory calibrated (DO NOT ADJUST)
Lower Limit	-1999
Upper Limit	1999

9.4 SPARE PARTS

9.4.1 115 Vac Parts List

Components that are more likely to need replacement are shown in **BOLD** type.

DESCRIPTION	PART NUMBER
Back Plate	HP-0014
Barrier Terminal Strip	HP-0020
Control Module	HP-0022
End Plate for Heater Block	HP-0003
FAN FOR 110 Vac OPERATION	HP-0023 *
Front Panel with Cutouts	HP-0004
Fuse Holder	200-91
FUSE, 10A, GLASS, LOAD	HP-0034
FUSE, 1/8A, GLASS, FAN	HP-0033
Grommet	HP-0028A
Handle	DIP-0029
Heater, 7", 250W	HP-0024
Heatsink, Left	HP-0006
Heatsink, Right	HP-0007
Inner Heater Case	HP-0008
Inner Heater Case End Cover	HP-0018
INSERTS (CL900 only)	SEE SECTION 9.4.3
Insert Guide	HP-0005
Intake Screen Bottom	HP-0026
Insulating Ring, Nylon	200-0004
Jack, 3 conductor	HP-0041
Label, Top Front Case	HP-0011
Label, Bottom Front Case	HP-0010
Label, Caution	L-1103
Label, 1/8A	L-1104
Label, 10A	L-1102
Lockwasher, #8 Heavy	SEL-0023
Lockwasher, #10 Heavy	HP-0035
Magnetic Strip	HP-0036
Nut, #10-32, Hex	HS-0260S
Nut, #8-32, Hex	DIP-0068/01
Strain Relief	DIP-0046
Outer Heater Case Bottom	HP-0013
Outer Heater Case Cover	HP-0012
Plug, Jack	HP-0040
POWER CORD, 9 FT, 16AWG	DIP-0045A
Rear Enclosure	HP-0015
Rear Exhaust Screen	HP-0029
REFERENCE CARD	MCD-0104
RTD Element	HP-0019
Rubber Feet	DIP-0026
* This item has a different part number in 220 Vac units. Refer to Section 9.4.2.	

9.4.1 115 Vac Parts List (continued)

Components that are more likely to need replacement are shown in **BOLD** type.

DESCRIPTION	PART NUMBER
Screw, #10-32 x 1" Long, Socket Cap	HS-0192S
Screw, #6 x 1/4" Long, Self Tap, Pan	DIP-0067S
Screw, #6 x 3/8", Type F	DIP-0072
Screw, #6 x 1/2" Long, Self Tap, Black	DIP-0067
Screw, #8-32 x 1/2" Long, Socket Cap	HS-0183S
Screw, #8-32 x 1/4" Long, Fillister Head	HS-0102
Screw, #8-32 x 3/8" Long, Fillister Head	HS-0339
Screw, #8-32 x 5/16" Long, Black Oxide	HS-0269
Screw, #8-32 x 1/2" Long, Pan Head	DIP-0065
Shield for Fan	HP-0031
Socket Head, #8-32 x 1/4" Long	HS-0370S
Solid State Relay	HP-0021
Spacer for Fan	HP-0030
Standoff, #8-32 through 1"	HP-0032
Stabilizing Block (CL900)	HP-0017
Stabilizing Block (CL950)	HP0046
Stabilizing Block Metal Shield	HP-0016
Stud, #8-32 x 3/8" Long	RPI-0011
Switch, Rocker, ON/OFF, DPST, 20A for 125 Vac	DIP-0054 *
Switch, Rocker, °C/°F, SPST, 20A for 125 Vac (16A/250 Vac)	DIP-0052
THERMALSTAT (above fan)	HP-0025
Thermalstat	HP-0027
* This item has a different part number in 220 Vac units. Refer to Section 9.4.2.	

9.4.2 220 Vac Parts List

The following two components are unique to 220 Vac units.

DESCRIPTION	PART NUMBER
* Fan for 220 Vac operation	HP-0023A
* Switch, Rocker, ON/OFF, DPST, for 250 Vac	DIP-0054A

9.4.3 Inserts Parts List (CL900)

DESCRIPTION (WELL SIZE)	PART NUMBER (INSERT)
1/8" dia. x 4" deep	CL901
1/8" dia. x 6" deep	CL902
3/16" dia. x 4" deep	CL903
3/16" dia. x 6" deep	CL904
1/4" dia. x 4" deep	CL905
1/4" dia. x 6" deep	CL906
5/16" dia. x 4" deep	CL907
5/16" dia. x 6" deep	CL908
3/8" dia. x 4" deep	CL909
3/8" dia. x 6" deep	CL910
Undrilled Insert	CL911
Insert Block Tongs	CL920

SECTION 10 SPECIFICATIONS

NOTE

All specifications assume that the test probe is in contact with the bottom of the well. See Section 5.1, Step 2.a, for probe length recommendations.

10.1 CONTROL PANEL

DISPLAY

PROCESS VALUE DISPLAY: Digital LED (0.4" high), red

SETPOINT DISPLAY: Digital LED (0.3152" high), green

PARAMETER DISPLAY: Setpoint, Control Output, Proportional Band, Integral Time, Derivative Time, High/Low Alarm Limit, Cycle Time, Alarm Sensitivity, Sensor Compensation, Lower/Upper Setting Limit

STATUS DISPLAY: Auto-tuning, High/Low Alarm, Control Output

SETPOINT SETTING

SETTING METHOD: Front membrane keypad

SETPOINT SELECTION: Parameter check, UP, DOWN, AUTO-TUNE, ENT, MODE KEY (13 modes)

SENSOR TYPE: RTD, Pt, 100Ω (alpha = 0.00385)

FACTORY SET PID VALUES

PROPORTIONAL BAND:	2.2%
INTEGRAL TIME:	105 seconds
DERIVATIVE TIME:	14 seconds
CYCLE TIME:	1 second (for other parameters, see Table 9-1)

10.2 CALIBRATOR

TEMPERATURE RANGE:	Low:	ambient +40°F (ambient +22°C)	
	High:	900°F (482°C)	
OPERATING AMBIENT TEMPERATURE:	40°F to 100°F (50°C to 38°C)		
ACCURACY:	CL900:	4" test well:	±3°F ±1 LSD of displayed resolution
		6" test well:	±1.5°F ±1 LSD of displayed value
	CL950:	±1.5°F ±1 LSD of displayed value	
CONTROL STABILITY:	±0.3°F or better		
TEMPERATURE UNIFORMITY:	CL900:	4" test well:	±0.4%, within 0 to 1" from the bottom of the test well
		6" test well:	±0.3%, within 0 to 1" from the bottom of the test well
	CL950:	±0.3%, within 0 to 1" from the bottom of the test well	
MAXIMUM PROBE INSERTION:	CL900:	4" test well inserts:	4" (100 mm)
		6" test well inserts:	6" (150 mm)
	CL950:	6" (150 mm)	
INSERT WELL INSIDE DIAMETERS (CL900):	1/8", 3/16", 1/4", 5/16", 3/8" nominal and undrilled insert		
POWER REQUIREMENTS:	Standard:	110-125 Vac, 50/60 Hz, 9.5A, 1.05kW	
	Optional:	220 Vac, 50/60 Hz, 4.8A, 1.05kW	
WEIGHT:	22.3 lb (10.1 kg)		
DIMENSIONS:	Refer to Figure 10.1.		

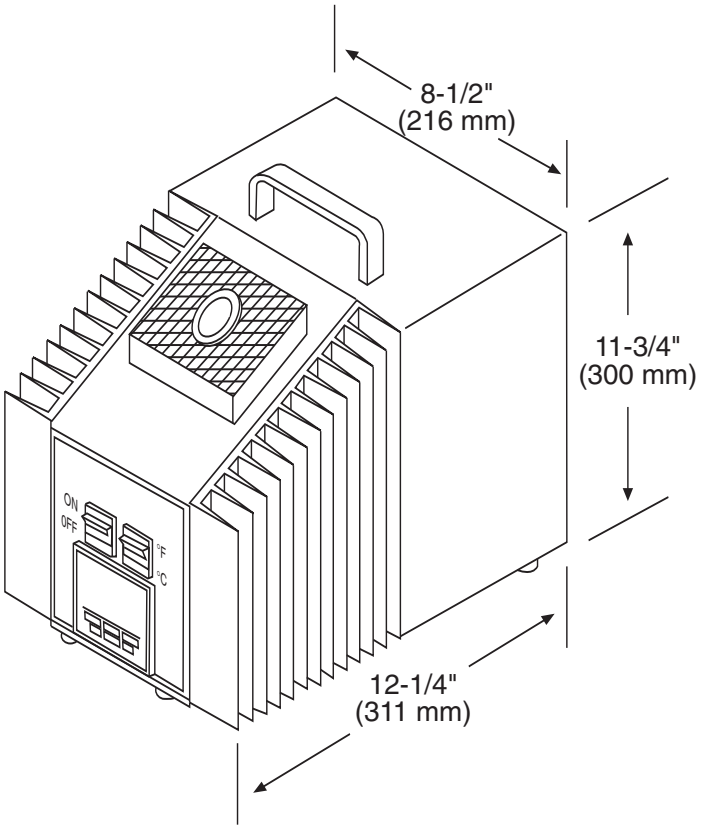


Figure 10-1. CL900 & CL950 Dimensions

SECTION 11 SCHEMATIC

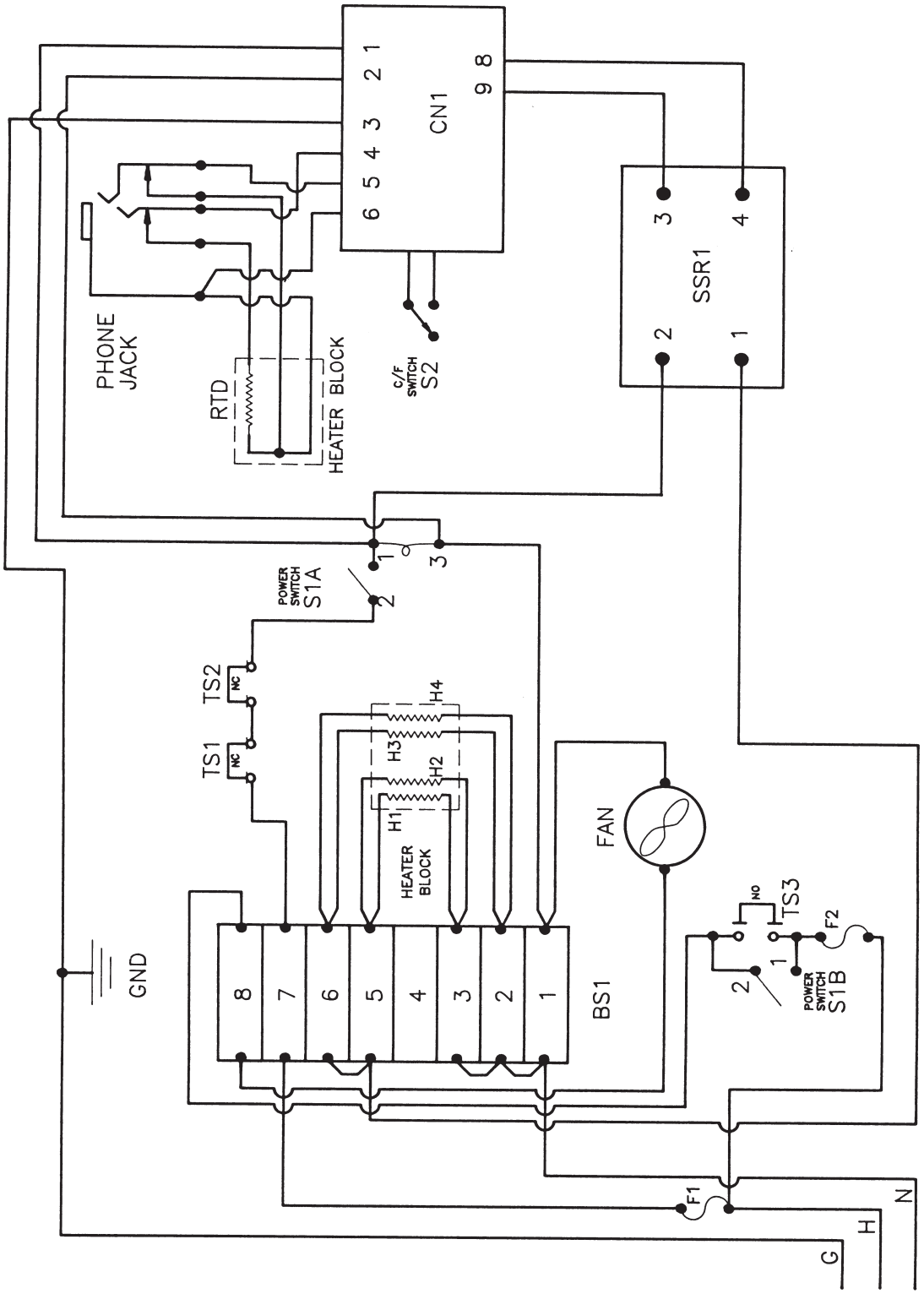


Figure 11-1. CL900 & CL950 (110V) Schematic

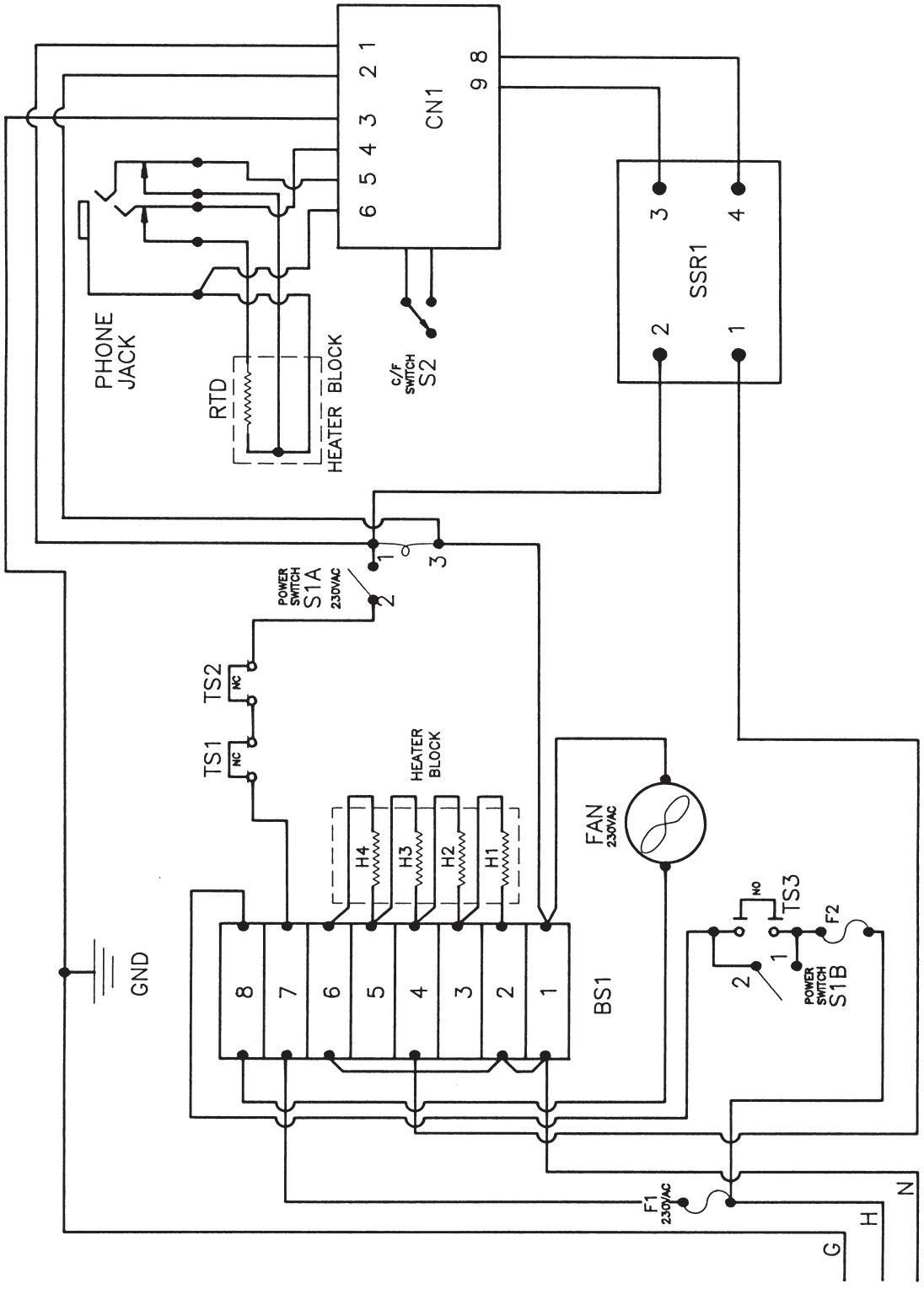


Figure 11-2. CL900 & CL950 (220V) Schematic

NOTES

SECTION 1 INTRODUCTION

OMEGA's TRCIII ice point™ Reference Cell relies on the equilibrium of ice and distilled, deionized water at atmospheric pressure to maintain six reference wells at precisely 0°C. The well extends into a sealed cylindrical chamber (containing the distilled, deionized water) whose outer walls are cooled by thermo-electric cooling elements. The increase in volume produced by the creation of ice crystals within the Reference Cell is sensed by the expansion of a bellows which operates a microswitch and controls the cooling elements. The alternate freezing and thawing of the ice accurately maintains a 0°C environment around the reference wells. The ice point Reference Cell is available in two models: 115 Vac model (part number: TRCIII) as well as the 220 Vac model (part number: TRCIII-220).

CAUTION
Protect the TRCIII from freezing conditions (including shipping). Damage will result if the unit is stored below 40°F.

Features of the ice point Reference Cell include:

- Provides a highly accurate 0°C thermo-electric "refrigerator"
- Eliminates old fashioned "ice bath"
- Supports versatile use in the factory, laboratory or instrument shop
- Calibrates all temperature instruments and temperature sensors
- Includes rugged outer case for safe portability
- Accepts up to 6 probes

Figure 1-1 shows the TRCIII ice point Reference Cell.

Figure 1-1. TRCIII ice point Reference Cell

SECTION 2 UNPACKING

Remove the Packing List and verify that you have received all equipment. If you have any questions about the shipment, please call the OMEGA Customer Service Department.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

Make sure the following is packed in the shipping box.

- TRCIII ice point Reference Cell
- Bottle of mineral oil (approximately 1 ounce)
- Operator's manual

SECTION 3 SAFETY

Operate the ice point Reference Cell in ambient temperatures between 35°F and 90°F (2°C and 32°C). Allow sufficient air circulation by leaving a minimum of 2 inches of space between the rear of the ice point Reference Cell and nearby objects. The thermo-electric cooling modules rely on free air convection over the two finned heat sinks. Refer to Figure 3-1.

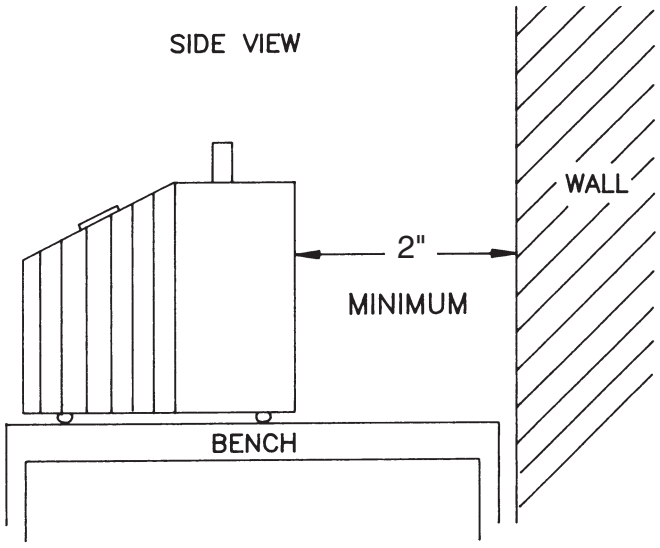


Figure 3-1. Location of the ice point Reference Cell

SECTION 4 PARTS OF THE ice point REFERENCE CELL

- On the top of the TRCIII is a handle for easy transportability.
- On the sloping front surface of the unit is the power switch and the power indicator light.
- Below the power switch and light are 6 reference wells (5/32" ID holes) where up to 6 thermocouple probes can fit in to be tested. Refer to Figure 4-1. These reference wells extend into a sealed cylindrical cell containing distilled, deionized water. The reference cell wall is cooled by thermo-electric modules. When ice is formed within the reference cell, an increase in volume is sensed by the expansion of a bellows. This bellows actuates a microswitch which turns off power to the modules. As the ice within the reference cell begins to melt, the bellows contract. This activates the microswitch, which in turn energizes the cooling modules. The microswitch actuator is factory-adjusted to maintain sufficient ice within the reference cell to maintain a well temperature within 0°C ± 0.1°C. The sensitivity of the bellows mechanism is such that the amount of formation and melting of ice will provide stability to within ± 0.04°C.

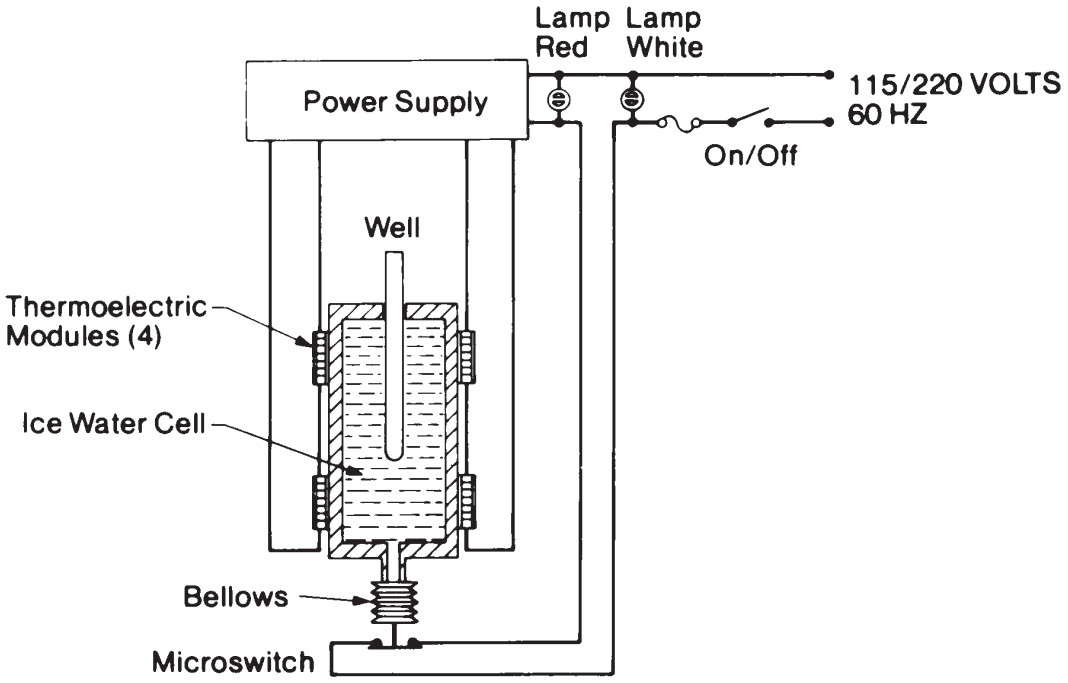


Figure 4-1. Interior View of the ice point Reference Cell

SECTION 5 OPERATING PROCEDURES

1. Place the ice point Reference Cell to allow a 2-inch minimum of free air space on all sides. The thermo-electric cooling modules rely on free air convection over the two finned heat sinks. NO fan is required. The rear section of the unit contains the power supply. Convective air cooling is provided through a perforated panel on the bottom and a louver on each side near the top of this section. Additional cooling is supplied by a perforated sheet metal enclosure between the rear section which contains the power supply and the heat sink section which houses the reference cell.
2. Plug in the unit and turn on the power switch. The red pilot light on the front panel will illuminate (showing that power has been applied and cooling has begun).
3. After 2 to 3 hours, depending on ambient air temperature, the pilot light will begin to cycle. This cycle period may vary between 30 seconds to 2 minutes. At this time, the equilibrium of the reference cell is reached and the unit may be placed in service.
4. Add 3 to 4 drops of mineral oil or other heat-transfer fluid to each of the 6 reference wells. Place reference thermocouples into the wells, making sure that the junctions are at the bottom of the reference wells.
5. The thermocouple wells are internally grounded to earth through the 3-wire power cord. However, if the wells need to be grounded to an external system so as to minimize electrical noise pickup, a standard adaptor plug may be used on the power cord plug. The ground wire from the adaptor plug should be connected to the external system ground.

SECTION 6 THERMAL "LOADING" OF THE ice point REFERENCE CELL

The thermocouple wire, which is inserted into the unit's reference well, will conduct some heat into the reference area. Obviously, if more thermocouples are placed in a well and the unit is working in a high ambient environment, more heat will be conducted into that well. The reference temperature may be affected if too great a "thermal load" (i.e., too many thermocouples) is placed on any given reference well. The unit is designed to remain within the published specification when all 6 wells are fully loaded with 6 OMEGA TRP probes. For accessory probes, refer to Section 9.

SECTION 7 APPLICATION NOTES

The ice point Reference Cell provides a precise 0°C temperature environment for thermocouple reference junctions, RTD (Resistance Temperature Detector) calibration, or any application requiring an accurate, stable, reference temperature.

Example 1: Thermocouple Reference Junctions

The most common ice point Reference Cell application is for use in referencing thermocouples. A thermal EMF is generated at any junction of dissimilar metals. To avoid generating an EMF at the terminals of readout instruments or terminal blocks, it is common practice to "reference" the thermocouple wire as shown in Figure 7-1. Thermocouple wire is joined to copper lead wire by welding or mechanical procedures.

The junctions are maintained at exactly 0°C in the wells. The copper lead wire is connected to the readout device (which normally has copper terminals and wiring). Standard thermocouple calibration tables are compiled on the basis of this arrangement; therefore, temperatures may be read directly from standard tables. Tables may be obtained from OMEGA Engineering.

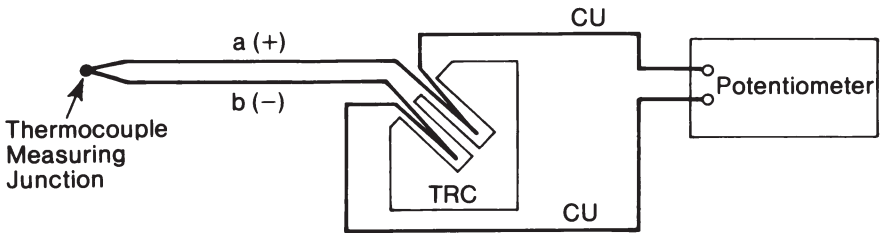


Figure 7-1. Common Thermocouple Reference Hookup

Example 2:

The ice point Reference Cell may also be used for calibrating temperature sensing devices such as RTDs, thermistors, or standard mercury or alcohol thermometers. To accomplish this, simply insert the device into one of the reference wells. The reference temperature is exactly the freezing point of water.

SECTION 8 TROUBLESHOOTING

The ice point Reference Cell has been designed for years of continuous, trouble-free operation. No periodic maintenance is required.

However, in case the unit fails to operate at any time, check the following items:

- Was the unit frozen or exposed to freezing temperatures during shipment or storage? If so, the reference cell may be damaged and will require factory repair.
- Is the fuse good? The fuse is located on the back panel of the unit. Replacement fuse size is 8AG, 2 amp.
- The microswitch may need adjustment. However, before any visual or mechanical checking can be done, the ice point Reference Cell must be shut off for a period of about 4 hours or until the well temperature has reached ambient temperature. Then, locate the small hole plug on the rear panel. It must be removed to make any adjustment. The adjustment screw may be reached by inserting a blade-type screwdriver with a shaft length of at least 2 3/4 inches. After turning the ice point on again, note if the pilot light is ON or OFF.

  If the pilot light is ON, make the following adjustments:

  1. Turn screw clockwise until the lamp turns OFF.
  2. Turn screw counter-clockwise until the lamp comes ON.
  3. Continue making 6 complete turns. Adjustment is then complete.

  CAUTION
  If the pilot light remains lit during this adjustment procedure, the ice point Reference Cell MUST BE returned to OMEGA for repair.

  If the pilot light is OFF, make the following adjustments:

  1. Turn screw counter-clockwise until the pilot light comes ON.
  2. Continue making 6 complete turns. Adjustment is then complete.

- If none of the above procedures correct the condition, contact the OMEGA Customer Service Department for help and directions on returning your TRCIII ice point Reference Cell.

SECTION 9 ACCESSORIES

The following probes may be ordered for use with the ice point Reference Cell:

PART NUMBER	THERMOCOUPLE TYPE
TRP-K	K CHROMEGA®-ALOMEGA®
TRP-J	J Iron - Constantan
TRP-E	E CHROMEGA® - Constantan
TRP-T	T Copper - Constantan
TRP-S	S Pt10% Rh - Pt
TRP-R	R Pt13% Rh - Pt
TRP-B	B Pt30% Rh - Pt6%Rh
TRP-G	G W - W26%Re
TRP-C	C W5%Re - W26%Re
TRP-D	D W3%Re - W25%Re

SECTION 10 SPECIFICATIONS

REFERENCE TEMPERATURE: 0°C

ACCURACY: 0°C ± 0.1°C or better

STABILITY: ± 0.04°C for constant ambient stability

AMBIENT TEMPERATURE RANGE: 35°F to 90°F (2°C to 32°C)

REFERENCE WELL: 6 wells, 5/32" ID, 3-3/4" deep. Wells are thermally and electrically grounded to each other

POWER REQUIRED: 115V, 60 Hz, 100 watts (220V also available)

STABILIZATION TIME: 2 or 3 hours depending on ambient temperature and thermal load

WEIGHT: 21 pounds (9.2 kilograms)

DIMENSIONS: Refer to Figure 10-1.

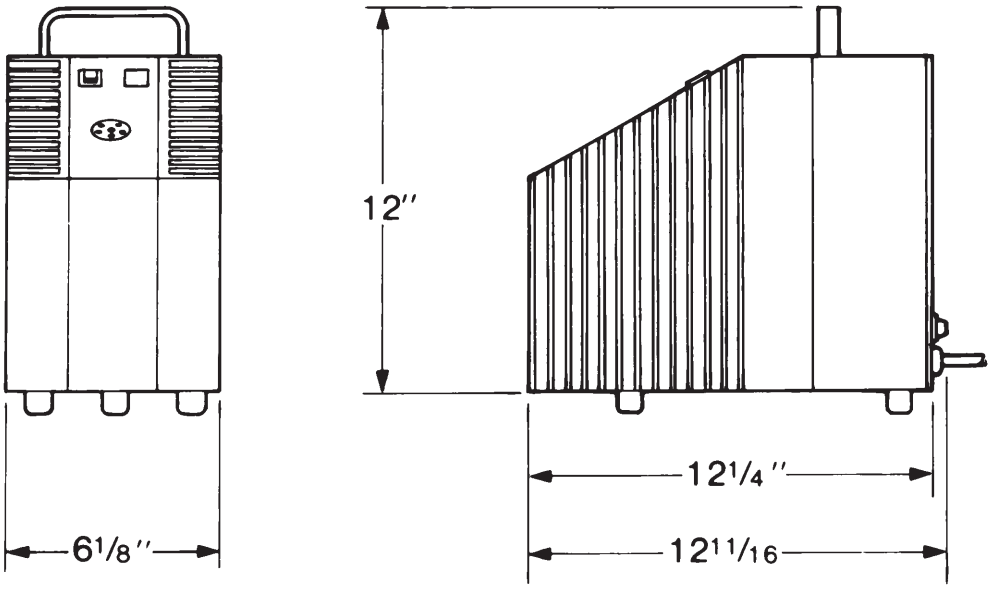


Figure 10-1. Dimensions

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MADE IN USA

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

PATENT NOTICE: This product is covered by one or more of the following patents: U.K. REGISTERED 2018337.

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- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

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- Cartridge & Strip Heaters
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- Flexible Heaters
- Laboratory Heaters

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- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

M1205/0110