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

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It is the policy of OMEGA Engineering, Inc. to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

WARNING: These products are not designed for use in, and should not be used for, human applications.

CL900 & CL950 hot point® Calibrators

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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, Changing the Controller Parameter.

1.2.1 CL900

The CL900 has a 6" deep test well that 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 ¼" diameter well that is 6" deep.
- Optional inserts are available with 4" and 6" depths, for ⅛", 3⁄16", ¼", 5⁄16", and ⅜" probe diameters (see Section 10.2 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 10.2 for part numbers.

1.2.2 CL950

The CL950 has a 6" deep built-in test well which accommodates 1⁄16", ⅛", 3⁄16", and two, ¼" 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.

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 at **1-800-622-2378 or 203-359-1660**. We can be reached on the internet at **omega.com; e-mail: customerservice@omega.com**

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	CL950 Calibrator
CL906 Insert	
(¼" diameter x 6" depth well)	Magnetized Reference Card
Insert Block Tongs	Operator's Manual
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 on 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 149°C (300°F).
- 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).
- DO NOT turn off the power switch until the heated calibrator has cooled down to under 149°C (300°F).

CAUTION:

- 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 149°C (300°F) or lower, and allow the unit to cool down to this temperature. When the CL900 has been operating in the 427°C to 482°C (800°F to 900°F) range, it will take approximately one hour and 15 minutes to cool down to 149°C (300°F).**
  2. **You may unplug the unit without causing damage when it reaches 149°C (300°F). If you turn off the power switch before reaching 149°C (300°F), the cooling fan will still operate intermittently. This allows the unit to cool down safely. However, when the CL900 has been operating at 482°C (900°F) and the power switch is turned off, cooling down to 149°C (300°F) can take as long as two hours.**
- **DO NOT UNPLUG THE CL900 WITH THE TEMPERATURE ABOVE 149°C (300°F) OR SEVERE DAMAGE MAY OCCUR.**

- Operate the calibrator at ambient temperatures between 5°C and 38°C (40°F and 100°F).
- Leave at least 230 mm (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.

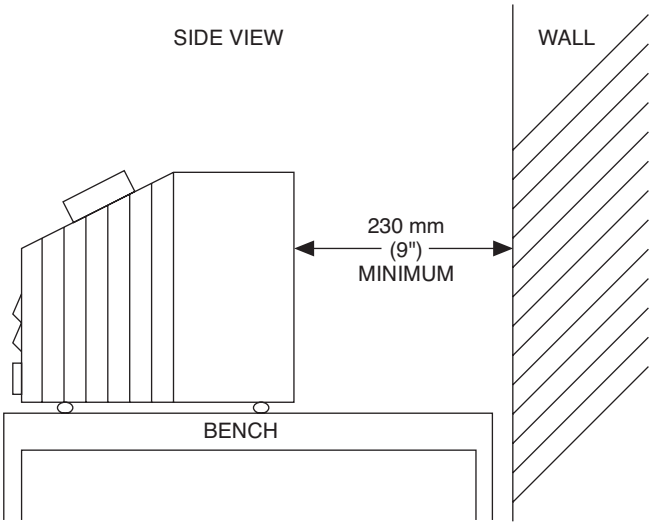

Figure 3-1. Bench Top Position of the hot point® Calibrator

- 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 149°C (300°F); 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 9.3 for more details.
- The hot point Calibrator is pre-programmed and factory calibrated for optimum performance. Refer to Section 6 for changing 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).
- 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 Calibrators

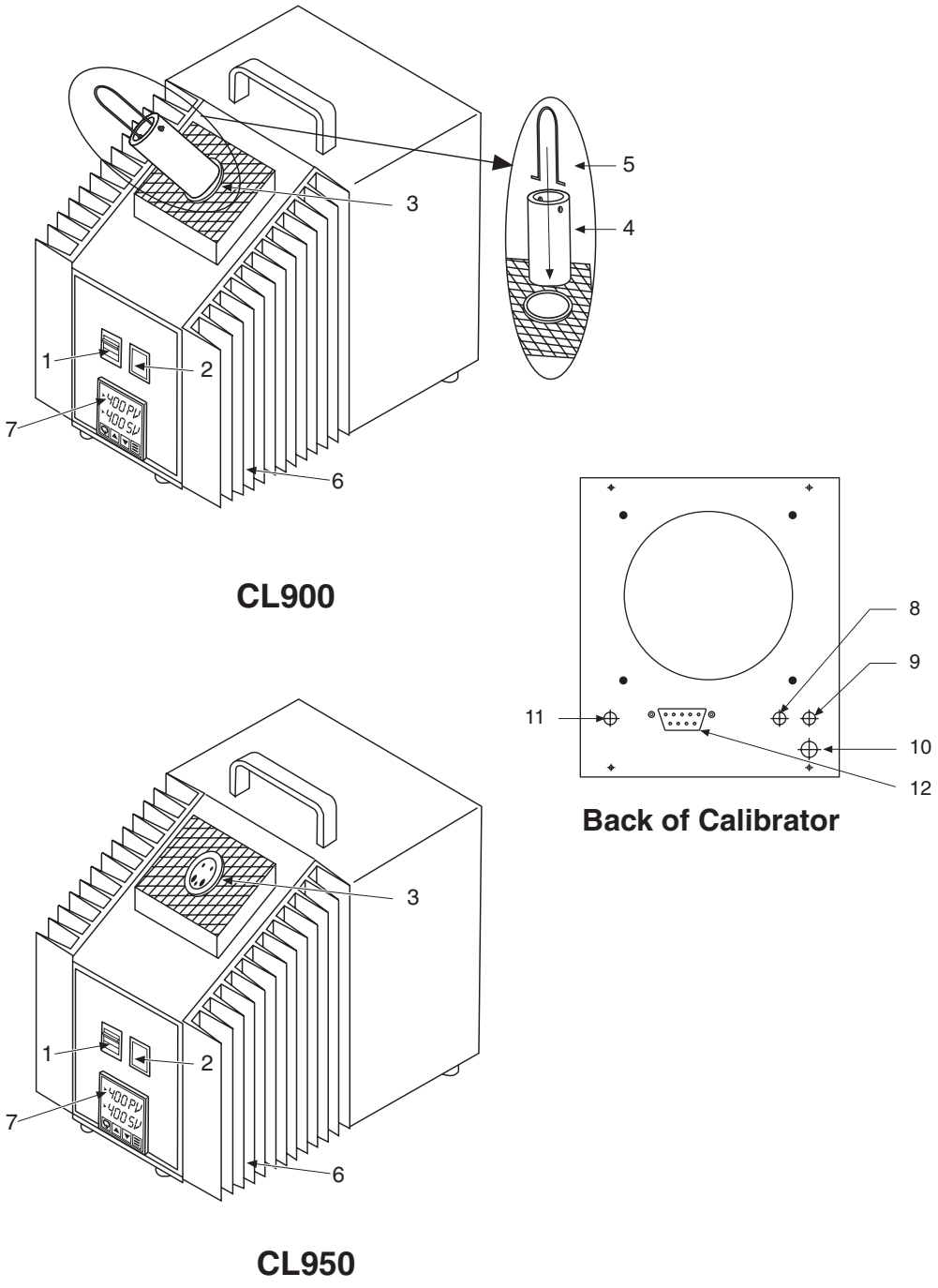

Figure 4-1. CL900 & CL950 Calibrator Parts

TABLE 4-1
CALIBRATOR PARTS & ACCESSORIES

KEY	LABEL	DESCRIPTION
1	**POWER SWITCH**	The switch has 2 positions labeled ON and OFF. Use ON for normal operation. OFF disconnects power to the entire unit with the exception of the cooling fan circuit.
2	**CYCLE INDICATING LAMP**	The lamp is located on the front panel of the calibrator to the right of the power switch. The red pilot light indicates the turning "on" and "off" of the heating cycle.
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 Figure 10-1 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 that 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 Figure 4-2 for additional information.
8	**FAN FUSE**	Controls the fan circuit only. The fuse has a fast blow, 3 AG, 1/8 A, 250 V rating.
9	**LOAD FUSE**	Controls all circuitry with the exception of the fan circuit. The fuse has a fast blow, 3 AG, 10 A, 250 V 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
12	**RS-232-PORT**	9 pin sub d connector for RS-232 communications

Temperature Controller:

The temperature controller provides a separate digital display for setpoint temperature as well as process temperature. Buttons are provided on the front panel for configuring the controller. The CL900/CL950 is shipped pre-configured. The customer should not alter any parameters except for the displayed engineering units (°C/°F).

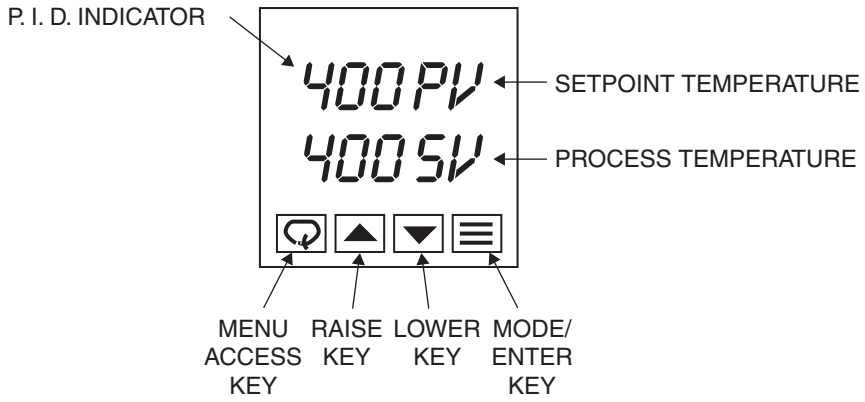

Figure 4-2. CL900 & CL950 Controller Display

P.I.D. Indicator:

When this light is illuminated, the unit is heating up the target plate.

NOTE

P.I.D. Control: Proportional, integral, derivative control (P.I.D.) is a temperature control algorithm used in high-end temperature controllers. The controller causes the process to attain the desired temperature by turning the process on or off. The process may be a heater or refrigerator. As the process temperature approaches the setpoint temperature, the hot or cold process will be pulsed to reduce the corrective measures and minimize overshooting. The controller provides a visual representation of the process status through LED indicators. An indicator may light continuously, blink, or shut off entirely to indicate that the process is on, being pulsed, or off, respectively.

Menu Access Key:

Hold down for 3 seconds, initially, to access the programming mode. Once in the programming mode, momentarily press this key to scroll through the menus.

Raise Key:

Momentarily press to increase the selected parameter or scroll upward in the list of possible settings.

Lower Key:

Momentarily press to decrease the selected parameter or scroll downward in the list of possible settings.

Mode/ Enter Key:

Hold down for 3 seconds, initially, to enter the standby setup mode. Once in the program mode viewing a parameter, use this key to save the current setting and advance to the next parameter.

Section 5 - Operating Procedures

- Operate the calibrator at room temperatures between 5° and 38°C (40° and 100°F).
- 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 whether 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. For long probes, the calibration process is more accurate using the 6" test well.

3. Check to see that the insert is seated properly in the stabilizing block.
4. Determine whether you are going to test probes in °C or °F. Set the temperature through the controller menu to °C or °F.
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. Select the desired temperature setpoint on the calibrator display.

3a. Use the ▲ or ▼ key on the front of the display to enter the new temperature setpoint value. The unit will begin heating the calibrating block to the temperature set on the setpoint display. See set @ 38°C (100°F)

3b. The setpoint variable will change at 3 different rates, depending on how long a key is being pushed. The minimum setpoint is 38°C (100°F), the maximum setpoint is 482°C (900°F).

4. For best results, wait approximately 15 minutes after the calibration block reaches the setpoint to allow the internal temperature of the calibrator to stabilize.

4a. The setpoint temperature appears on the green display.

4b. The actual temperature of the well appears on the red display.

4c. The temperature indicated on the red temperature display is your reference temperature for calibration.

5. 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 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 ⅛" 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.
- Allow time for the temperature to stabilize before proceeding with calibration.

6. 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 (see Steps 3 and 4). Compare the reference temperature on the calibrator with the temperature of the probe being calibrated. Repeat for each subsequent probe.
7. COOL-DOWN PROCEDURE: After you have calibrated the last probe, adjust the setpoint value to 149°C (300°F) or lower and press the ENT key (see Step 3). After the calibrator has cooled down to this temperature, turn off the power switch and unplug the unit (if necessary).

Section 6 - Changing the Controller Parameter

The CL900/CL950 operates at its optimum performance when left with the factory parameter settings. The only internal parameter that most operators may need to change is the engineering units (°C or °F). Below are two diagrams: a) menu hierarchy with factory default settings, b) programming procedure. In the event that some parameters have accidentally been changed, use the factory default settings shown below.

NOTE:

Changing any parameter settings other than the engineering units will decrease the accuracy of your calibrator.

Menu 00	Menu 01	Menu 02		Menu 03		Menu 04		Menu 05	
Key Lock	SETPOINT	Ac.Cd =	02	Ac.Cd =	03	Ac.Cd =	04	Ac.Cd =	05
	Ac.Cd								
		Gn.o1	113	**ALr1**	925	**id.no**	01	**SnSr**	P
		Gr.o2		ALr2		**bAUd**	12.o.7	Sn.00	
		rAtE	24	**Cy.t1**	01	CAL.L		dEC.P	
		rSEt	122	Cy.t2		CAL.H		FILt	
		H.Hys		**SP.tt**	OFF			**OUt.1**	Ht.P
		HyS.1		**L.SP.L**	80			**OUt.2**	ALR
		C.HyS		L.SCL				**CoL.t**	nor
		HyS.2		**U.SP.L**	900			**A1.HL**	HI
		C.SPr		H.SCL				**A1.Pd**	Pr
		SPr.2						**A1.OP**	LAt
		dPnG	NI					**A2.HL**	HI
								A2.Pd	Pr
								A2.OP	OFF
								Unit	F

Figure 6-1. Controller Menu Hierarchy Showing Factory Default Parameter Settings

WARNING:

Do not re-program the controller's parameter settings or change the wiring inside your unit to override the maximum setpoint value of 482°C (900°F).

Changing the controller's parameter settings:

1. Press the ⟲ key to enter the programming mode. The lower display will alternately display the menu level and "Ac.Cd."
2. Use the ▲ and ▼ keys to change to the desired menu level.
3. Once you have chosen the desired menu use the ⟲ key to scroll through the parameters. To change the setting of a given parameter, use the ▲ and ▼ keys.
4. To save settings press the ☰ key. The controller now exits the programming menu and returns to the normal operating mode.
5. To change settings on other menu levels, you must re-enter the programming menu (from step #1).

Figure 6-2. Programming Procedure

Section 7 - Interchangeable Test Inserts

The CL900 calibrator accepts a variety of standard and metric optional inserts, which are available in 4" and 6" depths, and for probe diameters from ⅛" to ⅜". An undrilled insert is also available for non-standard hole sizes.

7.1 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).

7.2 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 at 1/64".

Section 8 - RS232 Communication

This method allows bi-directional data transfer via a three-conductor cable consisting of signal ground, receive input, and transmit output. It is recommended that less than 15.2 meters (50 feet) of cable be used between the computer and this instrument. Note that multiple instruments cannot be tied to the same port in this configuration. The RS232 port is optically isolated to eliminate ground loop problems.

Below is a pinout diagram for the serial port of the CL900/CL950 as well as the pinout for a 9-pin PC serial port. Use a straight DB9(female) to DB9(male) connector cable to connect your computer to the CL900. The cable should be attached only when the computer and CL900 are off.

Only parameters in the parameter list should be modified or queried via the serial port. Other parameters should be viewed or querieddirectly from the controller. It is highly recommended that baud rate for the controller be modified on the controller directly. Note that both the CL900 and the computer must be communicating with the same serial communications parameters to establish a working communications link.

The serial communications feature can be tested using terminal emulation package. Note that this controller does not time-out waiting for the next character to be transmitted. Be sure not to use XON/XOFF or hardware handshaking. Lastly, it should be noted that following a complete transmission to the CL900, a response is sent back. If the message was valid, the changed or queried parameter is echoed back (following the same format). If the message was not according to acceptable format or was attempting to force a parameter out of range, an "ERROR" message is echoed.

Note, only RS232 protocol is supported by the serial port. Voltage levels are not to exceed ±12 Vdc. A standard 9-wire cable should be used, with shielding and DB9 connectors. The CL900/CL950 connections are female. Most computers have a 9-pin male connection. Hence, a male-female cable with straight-through connections is appropriate for interfacing.

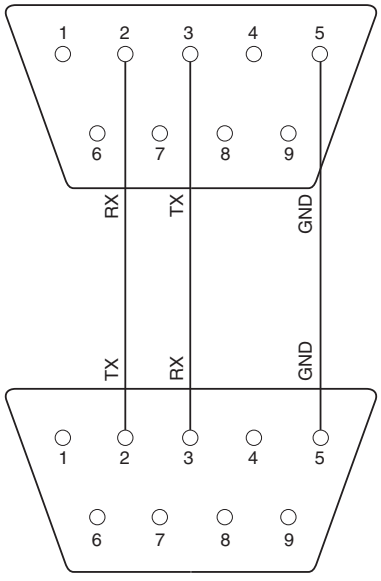

Figure 8-1. Connecting the CL900 to a Computer's Serial Port

Parameter List (only relevant parameters shown):

PAR#:	Parameter:	Range/ Units:
00	Process Temp.	Input determined
01	Setpoint	Input determined
19	Baud Selection	bAUd

Baud Selections:

Code:	Baud:	Parity:	Data Bits:	Stop Bits:
3.o.7	300	odd	7	2
6.o.7	600	odd	7	2
12.o.7	1200	odd	7	2 (factory default settings)
24.o.7	1200	odd	7	2
3.n.8	300	no	8	1
6.n.8	600	no	8	1
12.n.8	1200	no	8	1
24.n.8	2400	no	8	1

General Message Format:

#[controller id][command][parameter number]<new value><units>[CR/LF]

Definitions:

$\frac{1}{N}$ This character initiates an "escape sequence" that the controller will recognize.

[controller id] – Up to 2 numeric characters, '00' to '99' (factory default = '01').

[command] – 1 character, upper case or lower case.

'R' – To read a parameter from the controller.

'M' – To temporarily modify a controller parameter (lost upon shutdown)

'E' – To modify a controller parameter in non-volatile memory (saved even after shutdown).

[parameter #] – Up to 2 numeric characters, '00' to '99'.

<new value> $\frac{1}{N}$ This control word is used only when entering or modifying a parameter.

Up to 6 characters may be entered. The first character can be a space, a '+', or a '-'. The next 4 characters are for entering the new parameter value. Be sure to use the exact same field format as is currently being used. (i.e, if the XXX.X format is used to express temperature, be sure to enter a new value that conforms to the same format).

<units> $\frac{1}{N}$ This optional control word is used to specify units, C for °C, F for °F.

[CR/LF] – Every transmission must be terminated with a carriage return [CR] character. The line feed [LF] character is optional.

Section 9 - Maintenance

9.1 Calibration

This unit has been fine tuned at the factory and calibrated to give optimum performance at its full temperature range. It is recommended that the unit be returned annually for re-calibration.

9.2 Cleaning

CAUTION:

Remove all electrical connections and power before attempting any maintenance or cleaning.

9.2.1 Main Body

Only a damp soft rag with a mild cleaning solution should be used when cleaning the main body of this unit.

9.2.2 Probe Well

Send the unit back to OMEGA in the event that the probe well becomes dirty. Do not attempt to remove the probe well from the unit.

9.2.3 Fan and Vent Guards

The fan guard and vent guards should be cleaned annually. A medium-power vacuum cleaner with a brush attachment is recommended.

9.3 Fuse replacement

WARNING:

Disconnect power cord from source before replacing fuse.

CAUTION

For continued protection against the risk of fire, replace with only the same size, type, and rating fuse indicated here and on the rear panel of your unit.

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 to the calibrator may occur.

2. Unscrew the fuse cap and remove the blown fuse.

3 Insert a new fuse of the same type and current rating, then replace the fuse cap.

4. Plug the calibrator into the wall outlet.

5. Turn the calibrator ON using the ON/OFF switch.

Section 10 - Troubleshooting Guide

10.1 Troubleshooting Problems and Solutions

Problem	Solution
1. Unit will not turn on.	a. Check all electrical connections. b. Check rear panel fuses. c. Unit may require service. If problem persists, contact our customer service department.
2. Unit turns on but the probe well will not get hot.	a. Check that you have entered a setpoint above the ambient temperature. b. Verify that the controller is set to its factory default settings. c. Unit may require service. If problem persists, contact our customer service department. d. Unit may have been operated above ambient temperature operating range and safety cutoff switch has disabled heater. In that case, unit should be sent back to factory for reset and safety check.
3. Controller display shows "Err.H" and the probe well will not get hot.	a. Unit requires service. Contact our customer service department.
4. Probe well temperature will not stabilize to within ±0.5° of the setpoint temperature.	a. Verify that the controller parameters are set to factory default settings. b. Line voltage is not stable. c. Unit may requires service. Contact our customer service department.

10.2 Spare Parts

10.2.1 115 VAC PARTS LIST

TABLE 10-1

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 dif ferent part number in 220 Vac units. Refer to Section 9.4.2.	

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, 20 A for 115 Vac	DIP-0054*
Panel Lamp for 115VAC	DIP-0043
THERMAL SWITCH (above fan)	HP-0025
Thermal Switch	HP-0027
* This item has a different part number in 230 Vac units.	

10.2.2 230 VAC PARTS LIST

TABLE 10-2

The following three components are unique to 230 Vac units.

DESCRIPTION	PART NUMBER
Fan for 220 Vac operation	HP-0023A
Switch, Rocker, ON/OFF, DPST, for 230 Vac	DIP-0054A
Panel Lamp for 230 Vac	DIP-0148

10.2.3 PROBE WELL INSERTS FOR THE CL900

Probe Well Inserts with "Inch Sizes"			Probe Well Inserts with "Metric Sizes"		
OMEGA Part No.	Probe Hole Diameter	Probe Hole Depth	OMEGA Part No.	Probe Hole Diameter	Probe Hole Depth
CL901	1/8"	4"	CL901-M	2 mm	101.6 mm
CL902	1/8"	6"	CL902-M	2 mm	152.4 mm
CL903	3/16"	4"	CL903-M	3 mm	101.6 mm
CL904	3/16"	6"	CL904-M	3 mm	152.4 mm
CL905	1/4"	4"	CL905-M	4.5 mm	101.6 mm
CL906	1/4"	6"	CL906-M	4.5 mm	152.4 mm
CL907	5/16"	4"	CL907-M	6 mm	101.6 mm
CL908	5/16"	6"	CL908-M	6 mm	152.4 mm
CL909	3/8"	4"	-	-	-
CL910	3/8"	6"	-	-	-
CL911	UNDRILLED	6" Max.	-	-	-

TABLE 10-3

Section 11 - Specifications

NOTE:

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

11.1 CONTROL PANEL

DISPLAY

PROCESS VALUE DISPLAY: Digital LED, red

SETPOINT DISPLAY: Digital LED, 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

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

11.2 CALIBRATOR

TEMPERATURE RANGE:
Low: Ambient +22°C (Ambient +40°F)
High: 482°C (900°F)

OPERATING AMBIENT TEMPERATURE: 5°C to 38°C (40°F to 100°F)

ACCURACY:
CL900: 101.6 mm (4") test well: ±3°F ±1 LSD of displayed resolution
152.4 mm (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

11.2 CALIBRATOR continued

TEMPERATURE UNIFORMITY:	CL900:	4" test well: ±0.4%, within 2 to 25.4 mm (0 to 1") from the bottom of the test well 6" test well: ±0.3%, within 2 to 25.4 mm (0 to 1") from the bottom of the test well
	CL950:	±0.3%, within 2 to 25.4 mm (0 to 1") from the bottom of the test well
MAXIMUM PROBE INSERTION:	CL900:	100 mm test well inserts: 101.6 mm (4") 150 mm test well inserts: 152.4 mm (6")
	CL950:	150 mm (6")
INSERT WELL INSIDE DIAMETERS (CL900):	1/8", 3/16", 1/4", 5/16", 3/8", and nominal undrilled insert	
POWER REQUIREMENTS:	Standard:	115 Vac, 50/60 Hz, 1.05 kW
	Optional:	230 Vac, 50/60 Hz, 1.05 kW
WEIGHT:	10.1 kg (22.3 lb)	
DIMENSIONS:	Refer to Figure 11-1.	

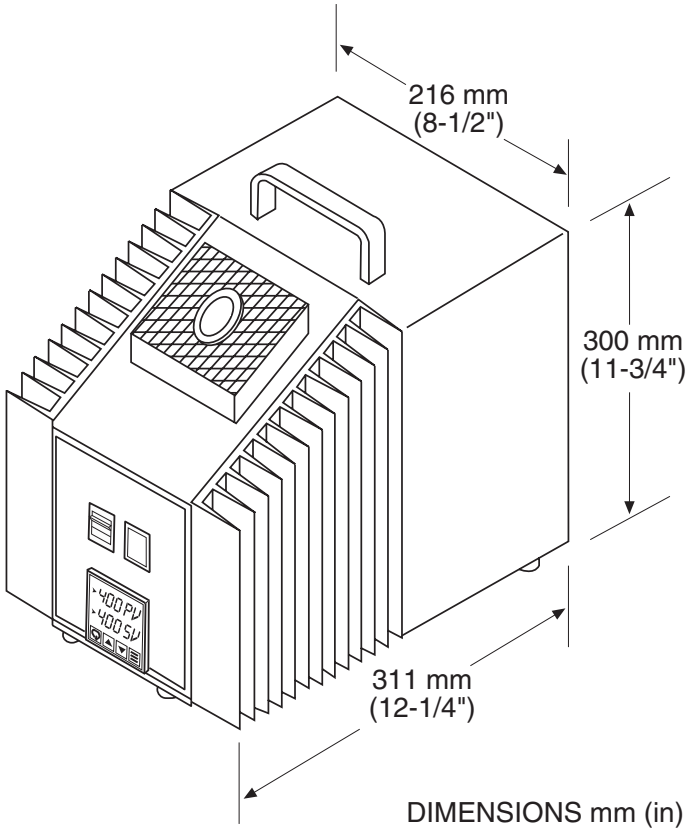

Figure 11-1. CL900 & CL950 Overall Dimensions

Section 12 - Schematic

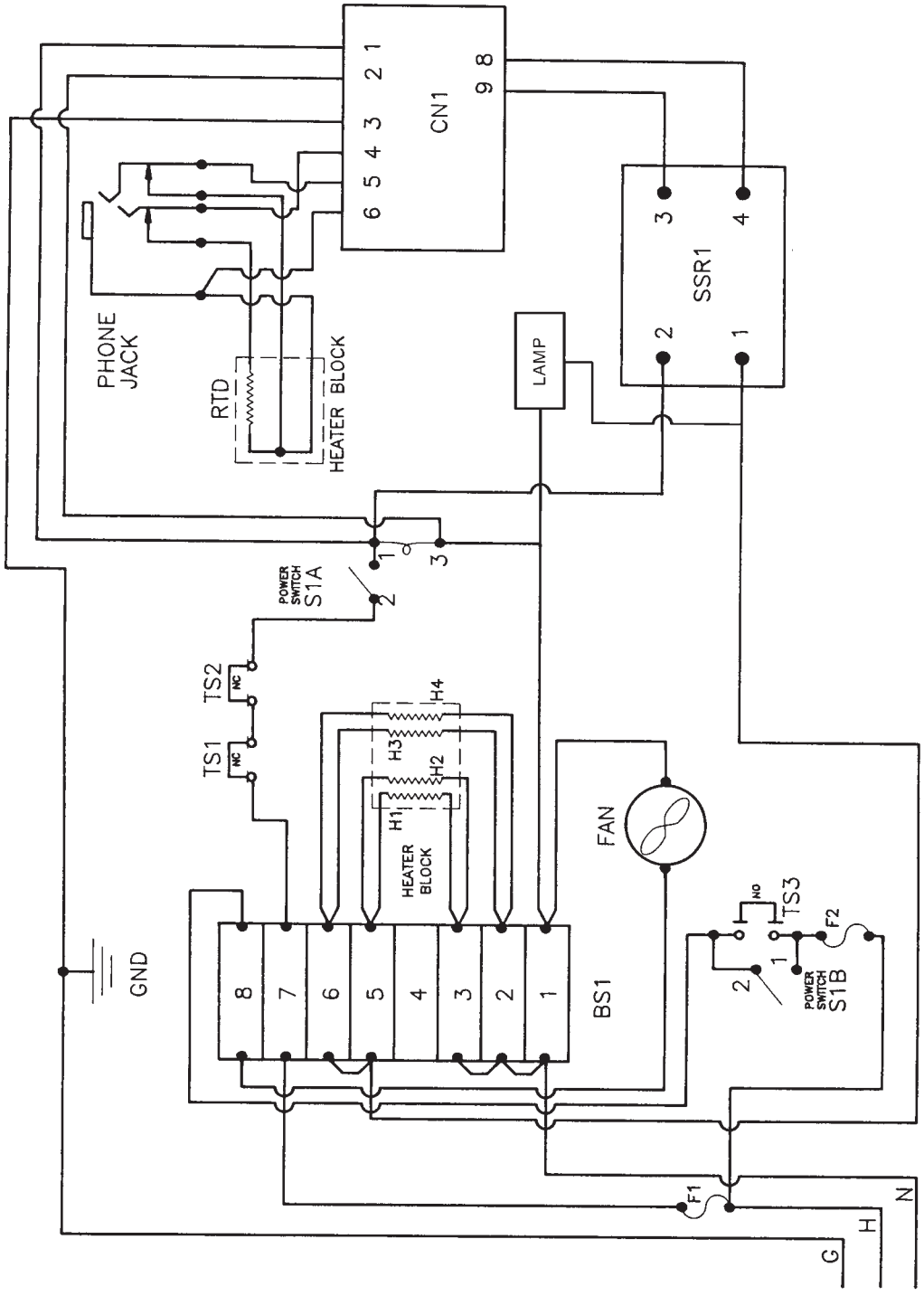

Figure 12-1. CL900 & CL950 (110V) Schematic

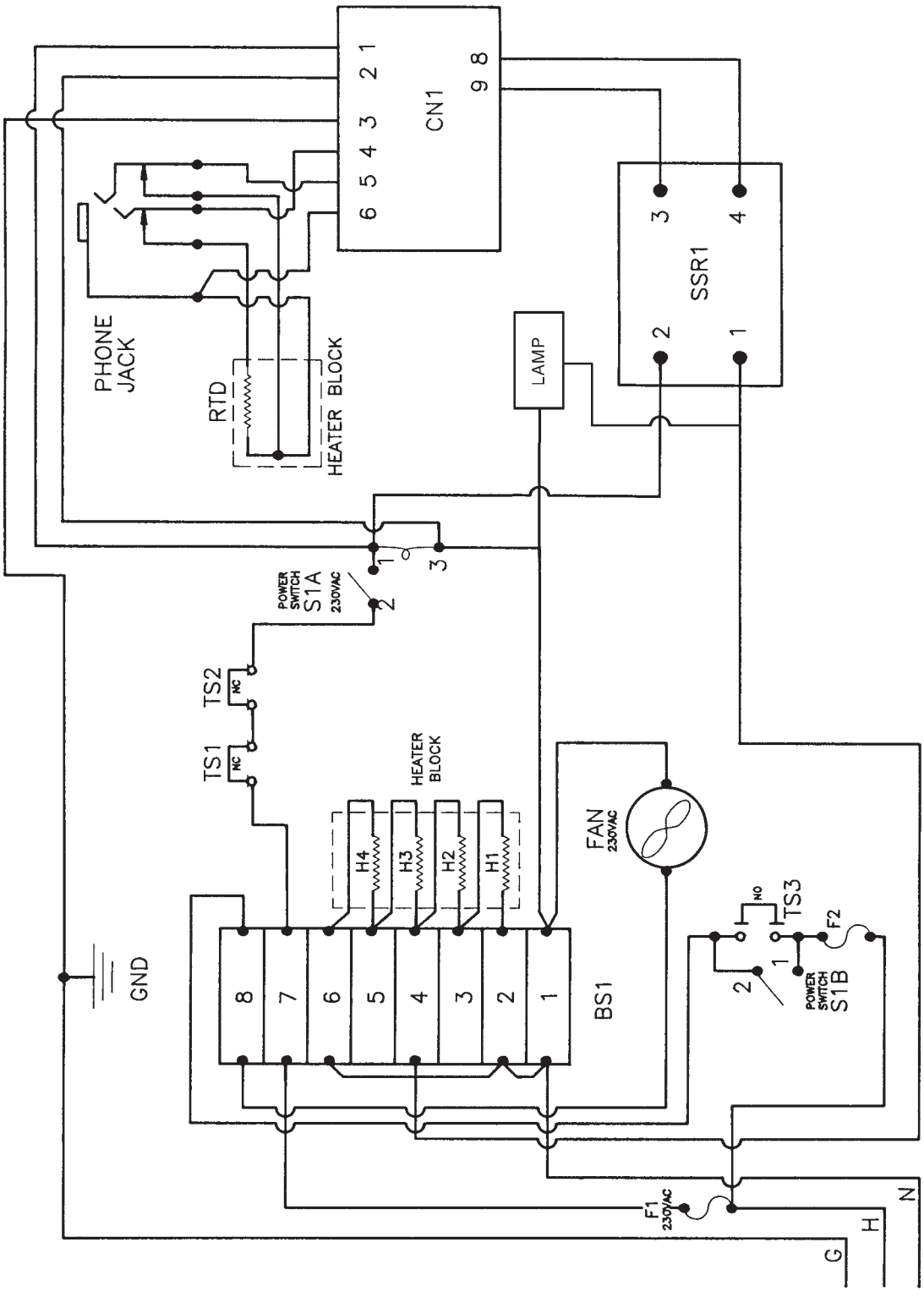

Figure 12-2. CL900 & CL950 (220V) Schematic

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 that 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 during shipping). Damage will result if the unit is stored below 40°F.

Main features of the ice point Reference Cell:

- Provides a highly accurate 0°C thermo-electric "refrigerator"
- Eliminates old-fashioned "ice bath"
- Supports versatile uses 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. 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 at **1-800-622-2378 or 203-359-1660**. We can be reached on the internet at **omega.com, e-mail: customerservice@omega.com**

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 are 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 2°C and 32°C (35°F and 90°F). Allow sufficient air circulation by leaving a minimum of 50.8 mm (2") 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.

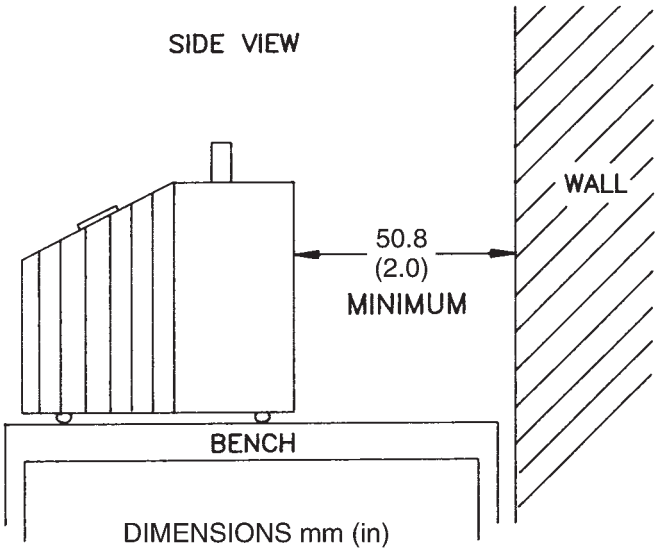

Figure 3-1. Bench Top Position of the ice point™ Reference Cell

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 (4 .0 mm [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 contracts. This activates the microswitch, that 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.

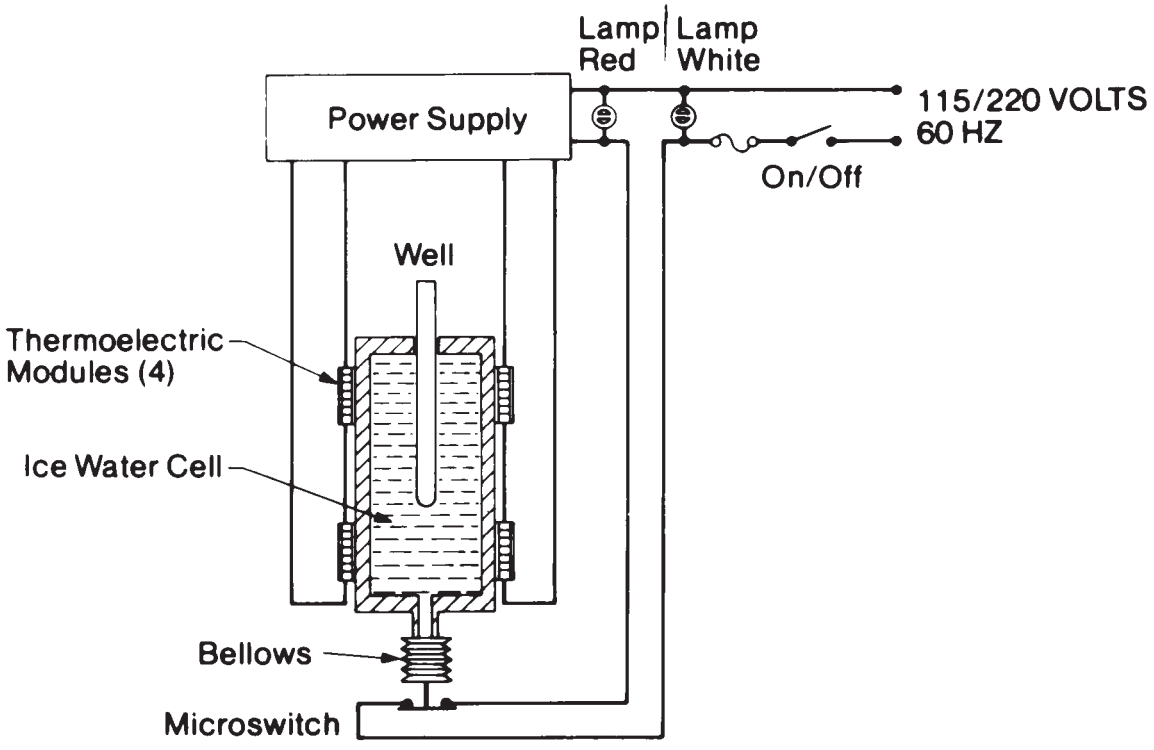

Figure 4-1. Internal View of the ice point™ Reference Cell

Section 5 - Operating Procedures

1. Place the ice point Reference Cell to allow a 50.8 mm (2") 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 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-temperature 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 specifications 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.

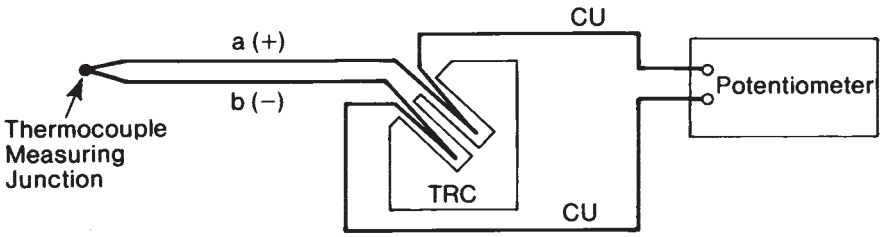

Figure 7-1. Common Thermocouple Reference Hookup

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 can be reached by inserting a blade-type screwdriver with a shaft length of at least 69.9 mm (2 ¾). 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 Temperature Reference Probes (TRP) 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:	2°C to 32°C (35°F to 90°F)
Reference Well:	6 wells, 4.0 mm (5/32") ID, 95.3 mm (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:	9.2 kilograms (21 pounds)
Dimensions:	Refer to Figure 10-1.

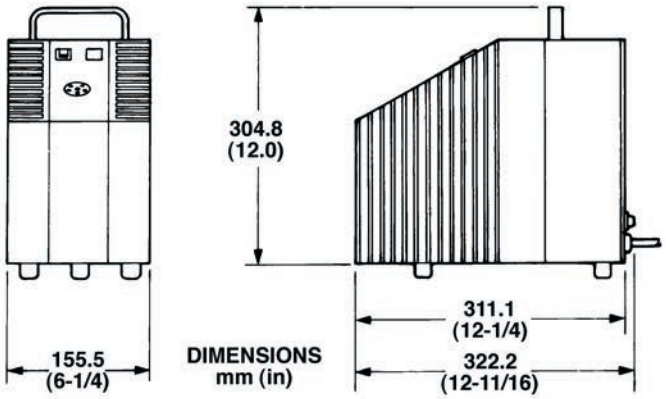

Figure 10-1. Dimensions

Figure 10-1. Overall Dimensions

NOTES:

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.S. PAT. D329,618/CANADA 69683 Ⓓ OMEGA ENGINEERING, INC./U.K. REGISTERED 2018337.

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- ☐ pH, Conductivity & Dissolved Oxygen Instruments

M1205A/0512