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CL1500 SERIES
Bench-Top Dry Block Calibrator

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U.S.A.:
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Omega Engineering, Inc., One Omega Drive, P.O. Box 4047
Stamford, CT 06907-0047 USA
Toll Free: 1-800-826-6342 TEL: (203) 359-1660
FAX: (203) 359-7700 e-mail: info@omega.com

Canada:

976 Bergar
Laval (Quebec), Canada H7L 5A1
Toll-Free: 1-800-826-6342 TEL: (514) 856-6928
FAX: (514) 856-6886 e-mail: info@omega.ca

For immediate technical or application assistance:

U.S.A. and Canada: Sales Service: 1-800-826-6342/1-800-TC-OMEGA®
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En Español: 001 (203) 359-7803 FAX: (001) 203-359-7807
info@omega.com.mx e-mail: espanol@omega.com

Servicing Europe:

Benelux:

Managed by the United Kingdom Office
Toll-Free: 0800 099 3344 TEL: +31 20 347 21 21
FAX: +31 20 643 46 43 e-mail: sales@omega.nl

Czech Republic:

Frystatska 184
733 01 Karviná, Czech Republic
Toll-Free: 0800-1-66342 TEL: +420-59-6311899
FAX: +420-59-6311114 e-mail: info@omegashop.cz

France:

Managed by the United Kingdom Office
Toll-Free: 0800 466 342 TEL: +33 (0) 161 37 29 00
FAX: +33 (0) 130 57 54 27 e-mail: sales@omega.fr

Germany/Austria:

Daimlerstrasse 26
D-75392 Deckenpfronn, Germany
Toll-Free: 0 800 6397678 TEL: +49 (0) 7059 9398-0
FAX: +49 (0) 7056 9398-29 e-mail: info@omega.de

United Kingdom:
ISO 9001 Certified

OMEGA Engineering Ltd.
One Omega Drive, River Bend Technology Centre, Northbank
Irlam, Manchester M44 5BD England
Toll-Free: 0800-488-488 TEL: +44 (0)161 777-6611
FAX: +44 (0)161 777-6622 e-mail: sales@omega.co.uk

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.

The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

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

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Section 1 - Introduction

Your CL1500 Series bench-top dry block calibrator has been designed for ease of use and reliability. It is important that you read this manual completely and follow all safety precautions before operating this instrument.

1.1 Precautions

- Follow all safety precautions and operating instructions outlined in this manual.
- Never leave your calibrator unattended when in use.
- Keep out of reach of all children.
- Never touch the probe well or probes when hot without proper protection.
- Never place any objects other than temperature probes in the well.
- Do not operate in flammable or explosive environments.
- Never operate with a power cord other than the one provided with your unit.
- Turn unit off and disconnect main power cord before attempting any maintenance or fuse replacement.
- Never disconnect main power cord or main power source when unit is still hot.
- Do not connect and or operate this unit to a non-grounded, non-polarized outlet or power source.
- This unit is intended for indoor use only. Avoid exposure to moisture or high humidity.
- Never operate the unit outside.
- Do not return your unit to storage when hot, allow unit to cool down to ambient temperature.

NOTE:

There are no user serviceable parts inside your unit. Attempting to repair or service your unit may void your warranty.

CAUTION:

This product is not designed for use in medical or nuclear applications.

NOTE:

There are no user serviceable parts inside your unit. Attempting to repair or service your unit may void your warranty.

1.2 Safety Warnings and IEC Symbols

This device is marked with international safety and hazard symbols in accordance with IEC 1010. It is important to read and follow all precautions and instructions in this manual before operating or commissioning this device as it contains important information relating to safety and EMC. Failure to follow all safety precautions may result in injury and or damage to your calibrator. Use of this device in a manor not specified by the manufacturer may impair protection provided within the unit.

IEC symbols	Description
	230 Vac @ 50 Hz (European Models) 115 Vac @ 60 Hz (Domestic Models)
	Caution, refer to accompanying documents
	Caution, hot surface

Figure 1. IEC Symbols

1.3 Statement on CE Marking

It is the policy of OMEGA® to comply with all world-wide safety and EMI/EMC 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.

1.4 General Description

The Model CL1500 is a portable, rugged, bench-top, hot/cold dry block calibration source with a built-in precision PID digital controller. The calibrator is used to test and calibrate temperature probes of various diameters. The calibration block has 6 holes to accommodate probes of varying diameter. It is available in both standard and metric versions. It can be set to any temperature between -5 to 125°C (+23 to 257°F).

1.5 Available Models

Model No.*	Probe Well Style	Hole Size
CL1500	Standard	See Fig. 2
CL1500M	Metric	

* Add suffix -230 for 230 Vac Models

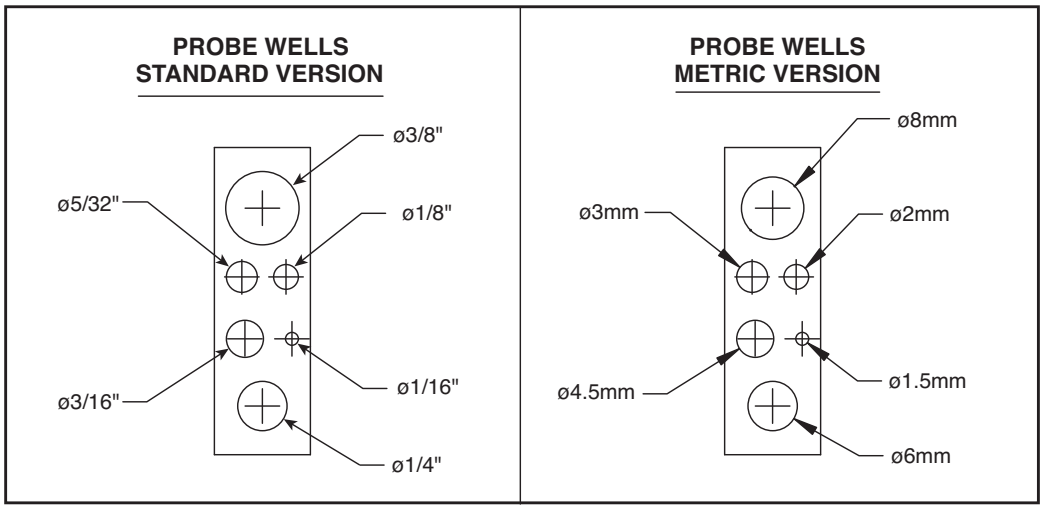

Figure 2. Probe Wells

Section 2 - Installation

2.1 Unpacking and Inspection

Remove the packing list and verify that you have received all your equipment. If you have any questions about the shipment, please call our Customer Service Department at **1-800-622-2378 or 203-359-1660.** We can also be reached on the Internet at **omega.com e-mail: info@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 damage claims unless all shipping material is saved for inspection. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

The following items are supplied in the box:

- CL1500 Dry Block Probe Calibrator
- Users Manual
- Calibration Certificate
- Power Cord
- RS-232 communications cable & Software CD

2.2 Mounting

Mount the unit on a bench, table top or shelf in a horizontal position and operate at least ten inches from any air obstructions to the fan, front panel, rear panel, bottom and top of the unit, in an ambient environment between the specified 0 to 45°C (32 to 113°F).

2.3 Environmental Operating Conditions

The unit is intended for indoor use only. Avoid exposure to moisture. The CL1500 is a Class II instrument. It is intended to be operated in laboratory environment only.

2.3.1 Ambient Temperature

The calibration block of the CL1500 can achieve any temperature within the specified temperature range of -5 to 125°C (+23 to 257°F) when being operated in normal ambient temperature 23°C (72°F) environments. As long as the ambient temperature does not exceed 25°C (75°F), the block will achieve its lower limit temperature of -5°C (23°F). The minimum block temperature the unit can achieve is proportionally higher with increased ambient temperature. An increase in Ambient temperature of 1°C (1.8°F) above the 23°C (72°F) increases the minimum probe well temperature by approximately 0.8°C (1.4°F).

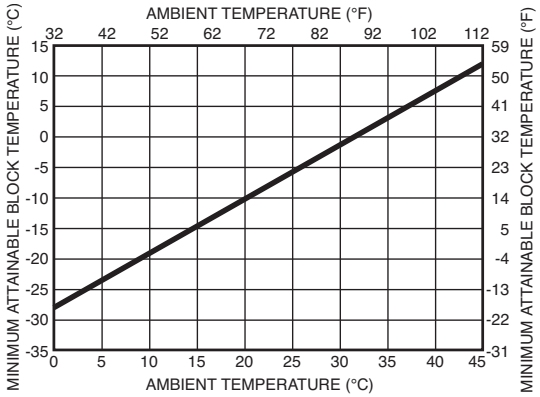

Figure 3. The Effect of Increased Ambient Temperature on Operating Temperature

2.3.2 Relative Humidity

Only operate your calibrator in a Relative Humidity environment of up to 80% RH (non-condensing).

2.4 Power Connection

WARNING:

High voltage is present at the power cord connection and inside the calibrator's enclosure when connected to the AC mains supply. Do not remove the top or bottom cover of the calibrator for any reason.

NOTE:

There are no user serviceable parts inside the calibrator. Attempting to service and/or repair your unit may void your warranty.

2.4.1 Standard (115 Vac~, 50/60 Hz Models)

The CL1500 comes with a standard North American 3-prong AC power cord. Do not use any other power cord other than the one provided. This cord provides the proper grounding and has been safety tested by the proper safety agencies.

2.4.2 International (230 Vac~, 50/60 Hz Models)

On "-230Vac" models an International style power cord with the proper color code and approvals is provided with stripped wire ends for connection to the proper connector used in your country or local area, this connector is not provided. Do not use any other power cord other than the one provided. This cord provides the proper grounding and has been safety tested by the proper safety agencies. Make sure when installing your connector to the wire ends that the ground connection has been made.

NOTE:

Fluctuations in the AC mains powering your calibrator can reduce the accuracy and/or stability of your calibrator. It is important that you connect your unit to a very stable power source of the proper voltage.

CAUTION:

Electrical connections and wiring should be performed only be suitably trained personnel.

Section 3 - Operation

3.1 Important Notes On Calibrator Operation

- 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 probe well can be set to high temperatures. Probes can be very hot when they are removed from the well. Take precautions to prevent personal injury to yourself, others and objects in the work area.
- After inserting or removing probes into the probe well allow the calibrator time to stabilize before making your measurement. Adding or removing probes changes the total mass of the probe well, the controller will require time to adjust for this change and stabilize back to the temperature you have set.

3.2 Front Panel Controls and Indicators

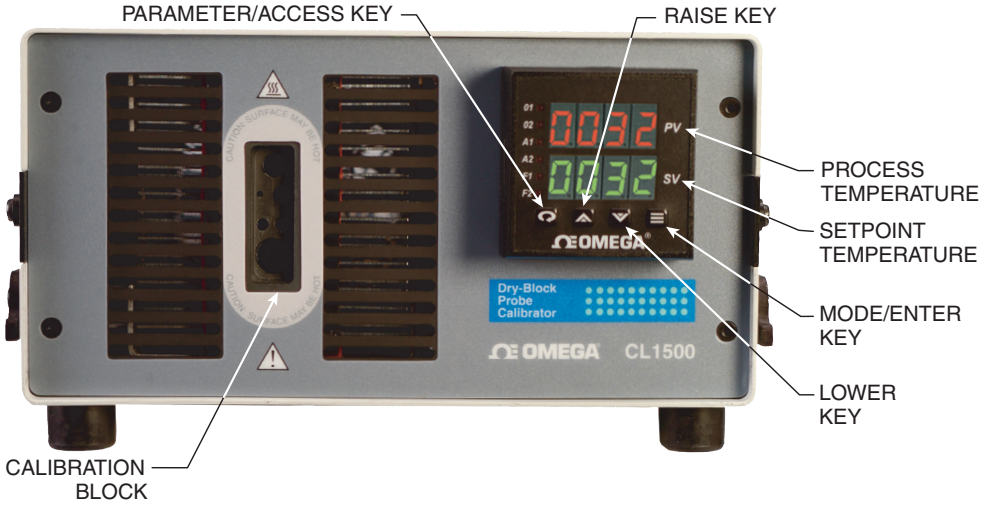

Figure 3. Front Panel Controls

Process Temperature

This field displays the current temperature of the calibration block.

Setpoint Temperature

This field displays the desired calibration block temperature. Once the block reaches this desired temperature, both displays will read the same value.

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 be lit continuously, blink or shut off entirely to indicate that the process is on, being pulsed, or off, respectively.

Parameter/Access Key

Used to index through parameters or to access Menu levels.

Raise Key:

Used to scroll up through available parameter settings, increase values or change menu levels (Hold for fast-step progression).

Lower Key:

Used to scroll down through available parameter settings, decrease values or change menu levels (Hold for fast-step progression)

Mode Key: This key is inactive.

Press to save settings and exit a menu level.

3.3 Back Panel Connections

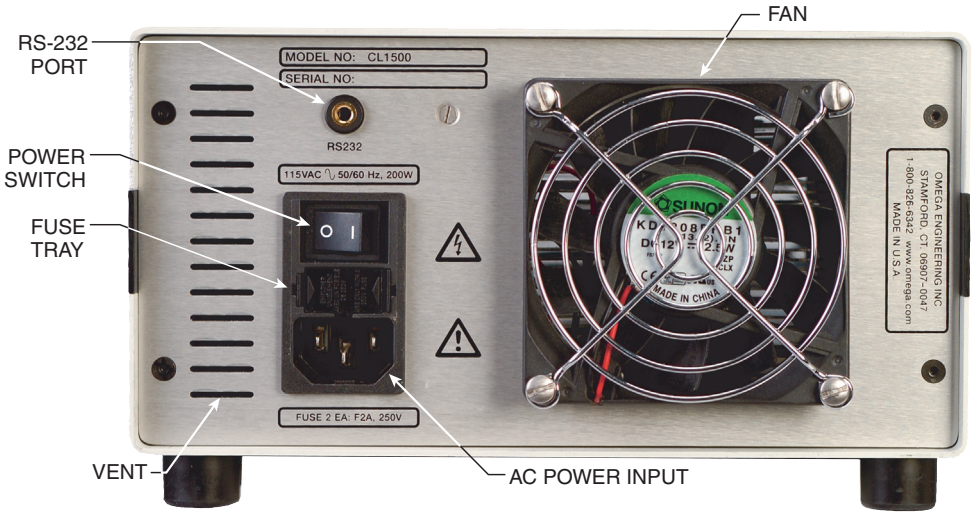

Figure 5. Back Panel

AC Power Input

The customer connects the power cord to the AC Power Input. Refer to Section 3.5 for information on fuse replacement.

Serial Port

The female RS-232 port allows the customer to make a 3-wire RS232 interface with the CL1500 and use the included free software for monitoring and control. A detailed description of this port is described in Section 4.

3.4 Overheat Reset Switch

If the unit is operated at high temperatures in elevated ambient temperatures, an overheat condition *may* occur. In an overheat situation a mechanical reset switch inside the unit will pop and open the heater circuit. The controller will still have power. While the controller will be demanding heat from the heater, the process temperature will fall or rise continuously until it equalizes with room temperature. If an overheat condition occurs, let the unit cool off for one hour. If this does not correct the problem, contact the factory.

3.5 Changing the Temperature Setpoint

The layout of the front panel is shown in Figure 3. The CL1500 incorporates a PID digital setpoint controller. The upper display indicates the calibration block temperature known as (PV) Process Variable, while the lower display indicates the programmed setpoint known as (SV) Setpoint Variable. Changes to the setpoint, units of measure and communication settings are made via the raise and lower keys. Pressing and holding a key will cause the setpoint temperature to advance more quickly to a desired value. Three scanning speeds are provided: slow, medium and fast. The lower setpoint limit and upper setpoint limit are at -23 and 257°F, respectively. While the min. and max. setting are changeable (see "Changing the Internal Parameters," Section 3.6), it is not advised as it may result in damage to the calibrator.

3.6 Changing the Controller Parameter Settings

The CL1500 operates at its optimum performance when left with its factory parameter settings. The only internal parameter that the operator should feel the need to change is the engineering units (°C or °F) or serial communications parameters. Figure 5 shows the menu hierarchy with factory default settings and Figure 6 shows the programming procedure.

Menu 00	Menu 01	Menu 02		Menu 03		Menu 04		Menu 05	
Key Lock	SETPOINT	**Ac.Cd =**	**2**	**Ac.Cd =**	**3**	**Ac.Cd =**	**4**	**Ac.Cd =**	**5**
	Ac.Cd								
		Gn.o1	100	**ALr1**		**id.no**	1	**SnSr**	d
		Gr.o2	1	ALr2		**bAUd**	96.n.7	Sn.00	
		rAtE	2	**Cy.t1**	0	CAL.L		dEC.P	
		rSEt	12	**Cy.t2**	0	CAL.H			
		H.Hys		**SP.tt**	OFF			**OUt.1**	Ht.P
		HyS.1		**L.SP.L**	-30.0			**OUt.2**	CL.P
		C.HyS		L.SCL				**CoL.t**	nor
		HyS.2		**U.SP.L**	125.0			**A1.HL**	HI
		C.SPr		H.SCL				**A1.Pd**	Pr
		SPr.2						**A1.OP**	OFF
		dPnG	OFF					**A2.HL**	LO
								A2.Pd	Pr
								A2.OP	OFF
								Unit	F

Figure 6. Menu Hierarchy Showing Factory Default Settings

NOTE:

Only the boldface parameters are active for the default mode of operation. The other parameters are not valid for operation with the cla. They are only listed for the sake of complete documentation of the controller.

I. To program internal parameters:

1. Press ≡ for 6 seconds until "stdby" appears.
2. Press ⟲ once or hold for 11 seconds until "Ac.Cd" appears.
3. Scroll through the menus using the ▲ ▼ keys.
4. Once the desired menu appears, scroll through the parameters of that menu using the ⟲ key.
5. Use the ▲ ▼ keys to adjust a given parameter.

II. To leave a menu and go into a different menu:

1. Press ≡ to save settings on a given menu until "stdby" appears.
2. Press ⟲ once to view current menu.

III. To save settings and exit (from menu selection level):

1. Press ≡ for 6 seconds until "tune" or "heat" or "cool" appears.
2. Press ≡ for 6 seconds until the process temperature and setpoint are displayed.

Figure 6. Programming Procedures

3.7 Heat-Up/Cool-Down Transition Time

The tables below illustrates the approximate time required to make transition from one temperature to another temperature in minutes for the CL1500. The temperature changes shown were made after the CL1500 was allowed to acclimate to room temperature, 23°C (72°F).

Temperature Change	Time
-5°C (23°F) to 23°C (73.4°F)	1 minute
23°C (73.4°F) to 100°C (212°F)	3 minutes
100°C (212°F) to 125°C (257°F)	5 minutes

Figure 7. Heating Times

Temperature Change	Time
125°C (257°F) to 100°C (212°F)	1 minute
100°C (212°F) to 0°C (32°F) to	8 minutes
0°C (32°F) to -5°C (23°F)	4 minutes

Figure 8. Cooling Times

3.8 Testing/Calibrating Temperature Probes

CAUTION:

Handle hot probes carefully. Use protection for your hands and the surface you will be placing the hot probes on after removing them from the well.

When calibrating probes at different temperature points, start at the lowest temperature and work up to the highest temperature. Do not jump up and down from a very hot temperature to a relatively cooler temperature. This will reduce the time it takes for the probe well to re-stabilize after you change the setpoint. When placing probes into the well, make sure the probe tip goes all the way down to the bottom of the probe well, the full 4.5". This will insure the degree of highest accuracy possible when taking your reading.

After calibrating each probe, remove it from the well and place it on a protected surface to cool. If you have another probe to calibrate, place it into the probe well and allow the calibrator a few minutes to re-stabilize.

3.9 Cooling Down Your Calibrator After Use

CAUTION:

Do not remove the power cord, main line power or turn the calibrator off until completing the cool-down procedure.

When you have completed working with the calibrator you must cool the unit down to ambient temperature if you intend to move your unit and/or return to storage.

Section 4 - RS232 Communication and Software

4.1 Serial Cable Connection

The CL1500 features a serial port that 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 fifty 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 cable pinout diagram for the serial port of the CL1500. The cable should be attached when only when the computer and CL1500 are off.

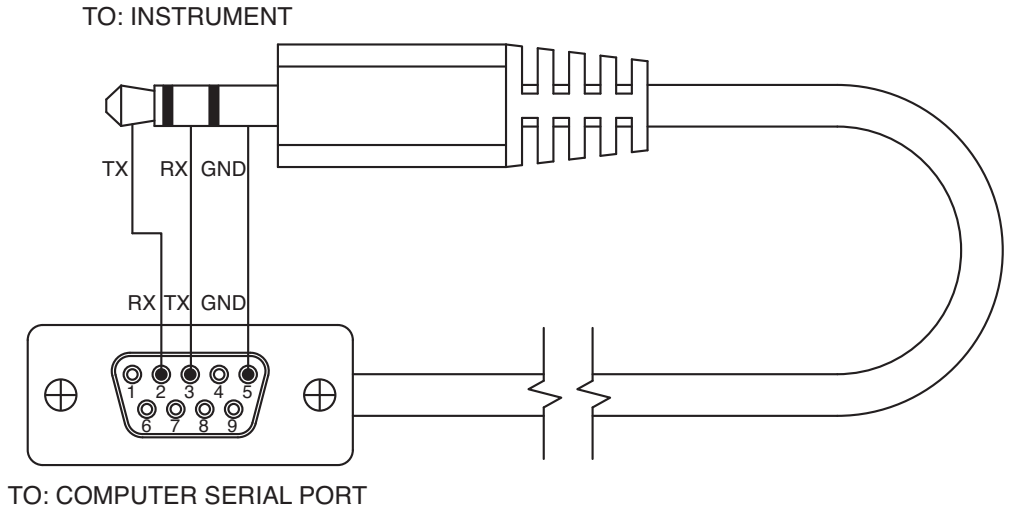

Figure 9. Connecting the CL1500 to a Computer's Serial Port

4.2 Free Control Software

The CL1500 ships with software for control and monitoring on a compatible PC with serial port. A free serial to USB cable is also included for use with computers that do not have a standard DB9 serial port.

Installing the CL1500 Programmer Software

Overview

The CL1500 Surface Probe Calibrator ships from the factory with a copy of the Omega Programmer software.
This is an easy to use software package, especially written for the CL1500 Calibrator. Only one instrument can run this software on one computer at a time.

Program Installation

It is advisable to have your MIS Department install this software into your computer. Always back-up your system before attempting to install this or any other software package into your computer.
Assuming you have backed up your computer files, run the install program. This program will run trouble free with Windows® 95, 98, ME, NT, 2000 or XP.

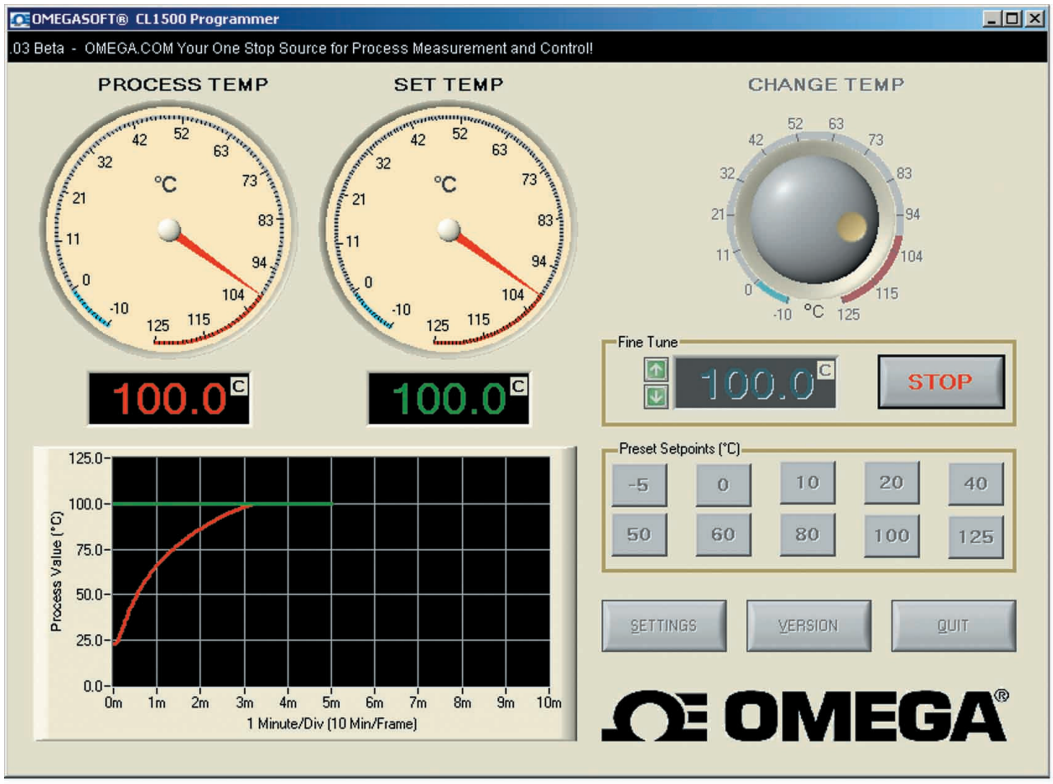

Figure 10. Main Screen

On your desktop, double click the CL1500 programmer icon. This will open a window and the Omega Logo (see figure 2) appears for a few seconds, then the main screen opens.

1. On the main screen top left there are two analog gages and two digital display windows below, one is red to indicate process temperature, the other is green to indicate set point temperature.
2. Below, there is a graph which tracks the set point and process values. The set point and process values are on the vertical axis, while the capture duration time is displayed along the horizontal axis.
3. On the top right the change temperature wheel will allow rough temperature setting between -5 to 125°C.
   Below it there is a fine tune up and down arrow that allows for fine tune settings in increments of 0.1 degrees.
   To the right there is the FIND button. Pressing this button will start tracking the set temperature on the controller.
4. The CL1500 programmer software includes 10 preset temperature settings ranging from -5 to 125°C.
5. SETTINGS: Pressing this button will bring a second screen into view (see figure 3).

   SOUND: Will allow audible indications while monitoring.
   Selections: ON, OFF
   Default: OFF

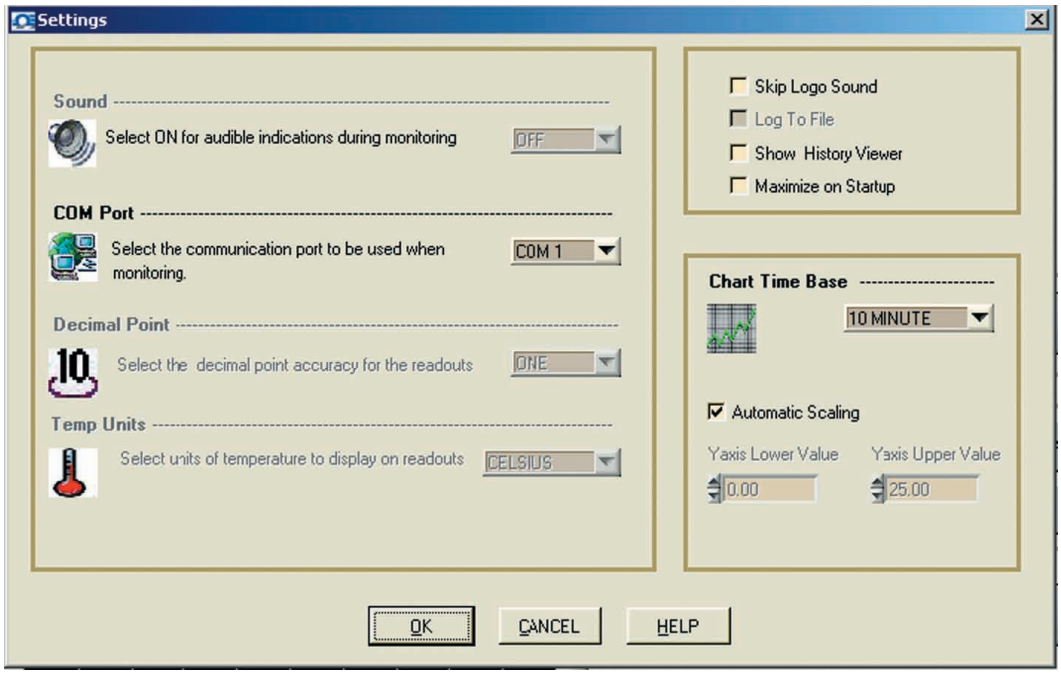

Figure 11. Settings Screen

COM Port: Selects the communication port to be used while monitoring.
Selections are: COM 1, COM 2, COM 3 or COM 4.
Default: COM1

DECIMAL POINT: Selects the decimal point accuracy for the readouts.
Selections: ONE, NONE
Default: ONE

TEMPERATURE UNITS: Selects units of temperature to display on readouts.
Selections: CELSIUS, FAHRENHEIT
This command is inactive at this time.

SKIP LOGO INTRODUCTION: Selecting this box will cancel the logo introduction when the program is activated from your desktop.

LOG TO FILE: Selecting this box will allow data login
This command is inactive at this time.

CHART TIME BASE: Allows user to set the horizontal time graph display
Selections are: 1 minute, 10 minutes and 1 hour

AUTOMATIC SCALING: Selecting this box will pre-select a vertical scale which varies according to temperature setting. Un-selecting this box, will allow user to set up values to zoom-in closer to the desired temperature range.

Section 5 - Maintenance

5.1 Calibration

This unit has been fine tuned at the factory and calibrated to give optimum performance of its full temperature range. It is recommended that the unit be returned annually for re-calibration. Please call our Customer Service Department at **1-800-622-2378 or 203-359-1660.**

5.2 Cleaning

CAUTION:

Remove all electrical connections and power before attempting any cleaning.

5.2.1 Main Body

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

5.2.2 Probe Well

Do not attempt to clean the probe well. Cleaning is not required.

5.2.3 Fan

The fan guard should be cleaned, as a minium, annually by using a compressed air source.

5.3 Fuse Replacement

WARNING:

Disconnect all power from source before attempting fuse replacement.

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.

For model: **CL1500** use	2 ea. 250 Vac, F2A (Fast-Acting, 2 Amp) UL/CSA Approved (5 mm dia. x 20 mm long)
For model: **CL1500-230** use	2 ea. 250 Vac, F1A (Fast-Acting, 1 Amp) UL/CSA Approved (5 mm dia. x 20 mm long)

Section 6 - Specifications

Temperature Range:	-5.0 to 125°C (23 to 257°F)
Internal Control Sensor:	Platinum RTD, 100 Ω, 0.00385
Accuracy:	±0.8°C (±1.4°F) [worst case]
Display Accuracy:	±0.3°C (±0.6°F) [over entire scale]
RTD Accuracy:	±0.4°C (±0.72°F) [worst case]
Stability:	±0.25°C (±0.5°F) or less **
Display Resolution:	0.1°
Well to Well Uniformity:	±0.55°C (±1°F)
Heat-Up Time:	from -5 to 125°C (9 minutes)
Cool-Down Time:	from 125 to -5°C (13 minutes)
Ambient Environmental Conditions	
Temperature:	0 to 45°C (32 to 113°F)*
Humidity:	0 to 80% RH, non-condensing
Well Depth:	114.3 mm (4.5")
Power Requirements by Model	
CL1500:	110-120 Vac 50/60 Hz, 200 W
CL1500-230 Vac:	208-240 Vac 50/60 Hz, 200W
Size:	206 x 79 x 203 mm (8.1" H x 3.1" W x 8" L)
Weight:	2.8kg (6.3 lbs)
Approvals:	CE (-230 Vac models only)
Installation Catagory II	

* Minimum temperatures that can be achieved is reduced when operating at ambient temperatures in excess of 23°C (73°F). See Section 2.3

** With stable, correct nominal line voltage.

Section 7 - Troubleshooting Guide

Problem	Solution
1. Unit will not turn on.	a. Check all electrical connections. b. Check rear panel fuses. c. Unit requires service, 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 requires service, contact our customer service department.
3. Unit turns on but the probe well will not get cold.	a. Check that you have entered a setpoint below the ambient temperature. b. Verify that the controller is set to its factory default settings. c. Unit requires service, contact our customer service department.
4. Controller display shows "Error" and the probe well will not get hot or cold.	a. Unit requires service, contact our customer service department.
5. Probe well temperature will not stabilize to within ±0.5°F of the setpoint temperature.	a. Verify that the controller is set to its factory default. b. Unit requires service, contact our customer service department.
6. Unable to communicate with the unit through the RS-232 connection port.	a. Check that you have made the proper wiring connections between your unit. and computer. b. Check for proper communication parameter settings in the controller and your computer. c. Unit requires service, contact our customer service department.

Section 8 - Glossary of Terms Used in This Manual

Calibration

The process of adjusting an instrument or compiling a deviation chart so that its reading can be correlated to the actual value being measured.

IEC

International Electrotechnical Commission

PID

Proportional, Integral, Derivative. A three mode control action where the controller has time proportioning, integral (auto reset) and derivative rate action.

RTD

Resistance temperature detector

Section 9 - The OMEGA® Family of Blackbody Calibrators

Listed below is a selection guide of OMEGA's current line of dry block probe calibrators that are in addition to the one you have selected. This family of rugged, portable and highly accurate calibrators covers a wide range of temperatures, well sizes and features making them perfect for temperature probe testing and calibration.

Model: CL900 "hot point®" Dry Block Probe Calibrator
Temperature Range: ambient +22 to 482°C (ambient +40 to 900°F)
Accuracy: ±1.5°F
Control Stability: ±0.3°F **Power:** 115 or 230 Vac (±10%) 50/60 Hz
Features: Removable inserts, Rugged benchtop design, Low cost

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Model: CL950 "hot point®" Dry Block Probe Calibrator
Temperature Range: ambient +22 to 482°C (ambient +40 to 900°F)
Accuracy: ±1.5°F
Control Stability: ±0.3°F **Power:** 115 or 230 Vac (±10%) 50/60 Hz
Features: 5 port well design standard, Rugged benchtop design, Low cost

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Model: CL900A "hot point®" Dry Block Probe Calibrator
Temperature Range: ambient +22 to 482°C (ambient +40 to 900°F)
Accuracy: ±1.5°F
Control Stability: ±0.3°F **Power:** 115 or 230 Vac (±10%) 50/60 Hz
Features: Removable inserts, Rugged portable/benchtop design, RS-232 Communication Standard, CE marked models

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Model: CL950A "hot point®" Dry Block Probe Calibrator
Temperature Range: ambient +22 to 482°C (ambient +40 to 900°F)
Accuracy: ±1.5°F
Control Stability: ±0.3°F **Power:** 115 or 230 Vac (±10%) 50/60 Hz
Features: 5 port well design standard, Rugged portable/benchtop design, RS-232 Communication Standard, CE marked models.

Model: TRClll1A "ice point™" Calibration Reference Chamber
Temperature Range: Fixed @ 0°C (32 °F)
Accuracy: ±0.1°C
Control Stability: ±0.04°C **Power:** 115 or 230 Vac (±10%) 50/60 Hz
Features: Digital display, Rugged portable/benchtop design, CE marked models

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Complete product specifications and features for these and additional calibrators can found and downloaded from our web site. Visit us at omega.com

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.

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- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- Transducers & Strain Gages
- Load Cells & Pressure Gages
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition & Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

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

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