

3 YEAR
WARRANTY

MADE IN
USA



User's Guide



Shop online at

omega.com®

— **OMEGA®** —

www.omega.com

e-mail: info@omega.com

ISO 9001
CERTIFIED
CORPORATE QUALITY

STAMFORD, CT

ISO 9002
CERTIFIED
CORPORATE QUALITY

MANCHESTER, UK

CL-307A SERIES

Thermovolt and Multivolt Calibrator

omega.com®

CEOMEGA™

OMEGAnet® On-Line Service
www.omega.com

Internet e-mail
info@omega.com

Servicing North America:

USA: ISO 9001 Certified
One Omega Drive, Box 4047
Stamford CT 06907-0047
Tel: (203) 359-1660
FAX: (203) 359-7700
e-mail: info@omega.com

Canada:
976 Bergar
Laval (Quebec) H7L 5A1, Canada
Tel: (514) 856-6928
FAX: (514) 856-6886
e-mail: info@omega.ca

For immediate technical or application assistance:

USA and Canada:
Sales Service: 1-800-826-6342 / 1-800-TC-OMEGA®
Customer Service: 1-800-622-2378 / 1-800-622-BEST®
Engineering Service: 1-800-872-9436 / 1-800-USA-WHEN®
TELEX: 996404 EASYLINK: 62968934
CABLE: OMEGA

Mexico:
En Español: (001) 203-359-7803
FAX: (001) 203-359-7807
e-mail: espanol@omega.com
info@omega.com.mx

Servicing Europe:

Benelux:
Postbus 8034, 1180 LA Amstelveen
The Netherlands
Tel: +31 (0)20 3472121 FAX: +31 (0)20 6434643
Toll Free in Benelux: 0800 0993344
e-mail: sales@omegaeng.nl

Czech Republic:
Fryštatska 184, 733 01 Karvina, Czech Republic
Tel: +420 (0)59 6311899 FAX: +420 (0)59 6311114
Toll Free: 0800-1-66342 e-mail: info@omegashop.cz

France:
11, rue Jacques Cartier, 78280 Guyancourt, France
Tel: +33 (0)1 61 37 2900 FAX: +33 (0)1 30 57 5427
Toll Free in France: 0800 466 342
e-mail: sales@omega.fr

Germany/Austria:
Daimlerstrasse 26, D-75392
Deckenpfronn, Germany
Tel: +49 (0)7056 9398-0 FAX: +49 (0)7056 9398-29
Toll Free in Germany: 0800 639 7678
e-mail: info@omega.de

United Kingdom: ISO 9002 Certified
One Omega Drive
River Bend Technology Centre
Northbank, Irlam
Manchester M44 5BD United Kingdom
Tel: +44 (0)161 777 6611 FAX: +44 (0)161 777 6622
Toll Free in United Kingdom: 0800-488-488
e-mail: sales@omega.co.uk

It is the policy of OMEGA 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 Engineering, Inc. 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.

CL-307A Series Thermocouple and Millivolt Calibrator

Remove the packing list and verify that all equipment has been received. If there are 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. 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 the packing material and carton in the event reshipment is necessary.

The following is supplied in the box:

- CL-307A with built-in miniature (SMP) thermocouple connector
- Carrying case
- Mating connector
- Beaded wire thermocouple (except for millivolt input model CL-307A-mV)
- TAS adapter
- 9 V battery
- Operator's manual

Section	Page
Section 1 Introduction	1-1
Section 2 Setting Up the CL-307A	2-1
2.1 Connections	2-1
2.2 Changing the Battery	2-1
Section 3 General Operation	3-1
3.1 Initial Setup	3-1
3.2 Over Range/Under Range	3-1
3.3 Configuring Temperature Scales	3-2
3.4 Locking in 1° Resolution	3-2
3.5 Configuring Operating Modes	3-3
3.6 Pyrometer Calibration	3-4
Section 4 Read Mode	4-1
Section 5 Source Mode	5-1
Section 6 Calibration for Thermocouple Models	6-1
Section 7 Calibration for CL-307A-mV	7-1
Section 8 Specifications	8-1

1.1 General Description

The OMEGA® CL-307A Thermocouple and Millivolt Calibrator measures, simulates, and stores thermocouple and millivolt readings over the entire industrial temperature range. Each model is dedicated for one type (J, K, T, E, R, S, mV) and is user programmable for either fixed °F or °C or front panel selectable °F/°C operation by an internal DIP switch.

The CL-307A provides high accuracy and stability. Automatic linearized cold junction compensation virtually eliminates temperature drift.

The millivolt input model CL-307A-mV sources and reads millivolts to calibrate and check recorders, mV transmitters and other millivolt input instruments.

Each CL-307A has a built-in miniature (SMP) thermocouple connector and is supplied with a soft carrying case, mating connector, beaded wire thermocouple, (except for millivolt input model CL-307A-mV), 9V battery, and a TAS adaptor.

1.1.1 Source Mode

The Source Mode simulates a thermocouple sensor. The thermocouple output adjusts with a unique multi-speed rotary-to-digital potentiometer. Rotate the pot continuously in either direction to set any value quickly and accurately.

Up to 8 mA output current is delivered to the receiver, enough to drive even most low impedance pyrometers.

The CL-307A sources key temperatures for repetitive calibrations. The “Quick Check” stores three output temperatures for real convenience. Store any temperature in either “HI” or “LO” registers. Test above or below stored values - just turn the knob up and down to check trip points, control action or hysteresis. Memory is retained even when power is off.

1.1.2 Read Mode

The Read Mode reads thermocouples directly. The digital indicator gives fast, accurate temperature measurement with 0.1 and 1°C resolution or millivolts with 0.01 and 0.1 millivolt resolution. High resistance or open thermocouples and leads are detected and indicated on the display. Two readings per second track fast moving temperatures.

“MAX” and “MIN” memories are continuously updated from turn on or whenever the “RESET” button is pressed. The CL-307A is a handy tool to monitor temperatures for drift or control deviation. Just flip the toggle switch to display the minimum and maximum temperature measured since reset.

2.1 Connections

It is essential for accurate calibration that thermocouple wire is used to connect the CL-307A to the device being calibrated. Simply plug the male subminiature thermocouple connector attached to the end of the thermocouple wire into the mating subminiature female connector built into the CL-307A for quick connections. Copper wires, copper connectors or copper adaptors are not recommended as they will cause errors in cold junction compensation. Copper is used only for millivolt applications.

2.2 Changing the Battery

Low battery is indicated by “BAT” on the front panel display. Approximately 10 hours of operation remain before the LCD goes blank and the CL-307A shuts itself down. Turn the CL-307A off, remove the four corner screws and lift the unit out of the case. The battery is fastened to the bottom printed circuit board and is easily removed. Replace screws and turn on when ready to use.

This page is intentionally blank.

3.1 Initial Setup

Each time the CL-307A is turned on, the LCD will display all segments for about one second. The currently selected temperature scale of °C or °F will then display for about three seconds. Depending on the configuration, °C or °F may be selected during turn-on.

The CL-307A is internally configurable for ease of use. Remove the four corner screws, set the DIP switches and follow the instructions below (a condensed guide is found in the calibrator housing).

1. Move the power switch to SOURCE or READ.
2. All segments on the LCD are turned on during self-test.
3. The display will indicate the selected temperature scale for three seconds. Press the SCROLL pushbutton to switch between °C and °F (based on configuration).

If fixed °C or fixed °F has been selected, the user prompt for this selection will be skipped during turn-on. The three Quick-Check temperature values will be the same as previously stored. The CL-307A will automatically convert the temperatures in memory between °F and °C. For example, if 212.0°F is stored in HI and the CL-307A is switched to °C, 100.0°C will be displayed.

3.2 Over Range/Under Range

Out-of-range temperatures are indicated by OVER and UNDER on the display. If out-of-range is displayed during READ mode, check for proper connections and thermocouple type.

3.3 Configuring Temperature Scales

The CL-307A may be internally set up for °C, °F, or selectable °C/°F operation. The selectable mode lets you choose °C or °F each time the unit is turned on (see Section 3.5).

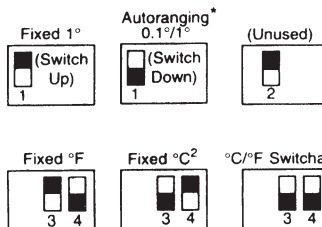
3.4 Locking in 1° Resolution

The CL-307A may be internally configured for autoranging 0.1°/1° or fixed 1° resolution. Select 1° resolution for less critical applications or autoranging for increased resolution.

3.5 Configuring Operating Modes (Setting DIP Switches)

1. Turn the CL-307A off.
2. Remove the four corner screws and lift faceplate assembly out of the case.
3. Set the DIP switches for your options as diagrammed below.

°C/°F selection is the default for shipments in the U.S.A. °C is the default for all other countries.



* Factory Setting (Switch 1 Down)

¹ Factory Setting — USA

² Factory Setting — All other countries

3.6 Pyrometer Calibration

Some thermocouple input pyrometers and controllers operate on the D'Arsonval meter movement principle. Millivolts from the thermocouple input drive a low resistance coil directly. For example, a coil may have a typical resistance of 60 ohms. Since the pyrometer resistance is so low, resistance of the input thermocouple leads must be taken into account. Pyrometers of this type have fixed or adjustable series resistance which corrects for lead length resistance.

To use the CL-307A to drive low resistance loads:

1. Disconnect the sensing thermocouple leads at the thermocouple head.
2. Connect leads from the CL-307A to the extension wires going to the pyrometer, using the screw connectors in the head. (If the sensing thermocouple sheath is within 1/4 to 2 times the length of the CL-307A lead length, the error due to resistance will be negligible).
3. Set the temperatures to be used for calibration per the recommendation of the pyrometer manufacturer.

If the thermocouple head cannot be accessed:

1. Determine the installed length of extension wire between the head and the pyrometer.
2. Select thermocouple extension wire of the same type, wire size and length as the installed wire between the head and the pyrometer to make up a calibrating wire.
3. Replace the active thermocouple extension wire with the calibrating wire at the pyrometer terminals.
4. Connect the other ends of the calibrating wire to the CL-307A and calibrate the pyrometer.

A resistor of the same ohm value as the wire between the head and the pyrometer may be used in series with one lead instead of a length of calibrating wire. Make certain that both input and output leads to the resistor are the same temperature.

This page is intentionally blank.

4.1 Read Mode (Measure Thermocouples)

1. Set up the CL-307A for the correct temperature scale ($^{\circ}\text{C}$ or $^{\circ}\text{F}$).
2. Disconnect the wires from the thermocouple to be read or checked.
3. Connect the CL-307A to the sensor, being careful to observe proper polarity and thermocouple type.
4. Display present reading, Maximum or Minimum temperature.

Whenever Read Mode is selected, the word “READ” will appear on the LCD. The CL-307A can measure temperatures with resolution autoranging between 0.1° and 1° resolution or with fixed 1° resolution. The display is update twice per second to continuously track fast-moving temperatures.

4.2 MIN/MAX Values

To read the Maximum or Minimum temperature since input mode was entered, switch to MAX or MIN. The value will appear on the LCD along with the word MAX or MIN. The MAX/MIN values are automatically updated and may be viewed at any time without disturbing the other values. Pressing the RESET/SCROLL button will transfer the present temperature into both MAX and MIN and update them as the measured temperature changes.

4.3 Open Thermocouples

The CL-307A checks for open or high resistance thermocouples. Open or burned out thermocouples are indicated by “----” on the display. Temperatures out of range for the T/C TYPE selected will be indicated by OVER and UNDER on the display.

5.1 Source Mode

1. Set up the CL-307A for the correct temperature scale (°C or °F).
2. Disconnect the input wires from the device to be calibrated or checked.
3. Connect the CL-307A to the device being calibrated, being careful to observe proper polarity and thermocouple type.
4. Adjust the digital pot to the desired output value.

Whenever Source mode is selected, the word "SOURCE" will appear on the display. To change the output value, turn the speed-sensitive digital pot. Turning the pot slowly will cause a gradual change in the output. A faster change will occur when the pot is turned faster. This function operates in all three output positions (HI, SET and LO).

5.2 Store

1. Switch to HI or LO.
2. Turn the digital pot to the desired value.
3. Press the STORE/SCROLL button. The LCD will flash once to show that the value was saved.

5.3 Quick-Check

Any time you need a stored value, use the QUICK-CHECK switch. Any value in the thermocouple range may be stored in HI and LO. The CL-307A retains the HI, LO and SET values for you with the power on and off.

5.4 Overload

The CL-307A will indicate OVER and blank the digits on the display when the output leads have been shorted or when the device being calibrated requires more than 10 mA.

6.1 Suggested Equipment

1. Precision millivolt source capable of $\pm 0.003\text{mV}$ accuracy with a full scale of 100mV or greater and a resolution of 0.001mV.
2. Precision digital voltmeter capable of $\pm 0.003\text{mV}$ accuracy with a full scale of 100mV or greater and a resolution of 0.001mV. (OMEGA recommends a DMM with 6-1/2 digits or greater).
3. An ice bath stable to within 0.1°F or the OMEGA TRC-III Electronic Ice Point Reference Cell.
4. Thermocouple probe with NIST traceability.

6.2 Precautions

1. Observe antistatic procedures.
2. Avoid touching thermocouple connections, as this will cause temperature errors in calibration. It is recommended that the CL-307A be handled as little as possible during calibration to reduce errors. If the unit is held without its box, the heat from your body may cause uneven heating of temperature sensitive components.

3. Before any adjustments are made to the CL-307A, fresh batteries (alkaline 9V) should be placed in the unit.

Refer to Figure 6-1 for location of test points and adjustment potentiometers. Allow one hour for the CL-307A to stabilize to the ambient temperature of the calibration room.

6.3 DC Millivolt Calibration

1. The user's DIP switch positions should be recorded in Table 1.
2. With the CL-307A in the OFF position, put all DIP switches up.
3. Connect the precision millivolt source to the CL-307A input terminal screws (on the bottom printed circuit board) using copper wire while observing proper polarity (see Figure 1).

CAUTION

Make sure that the ends of the thermocouple wire are not shorted.

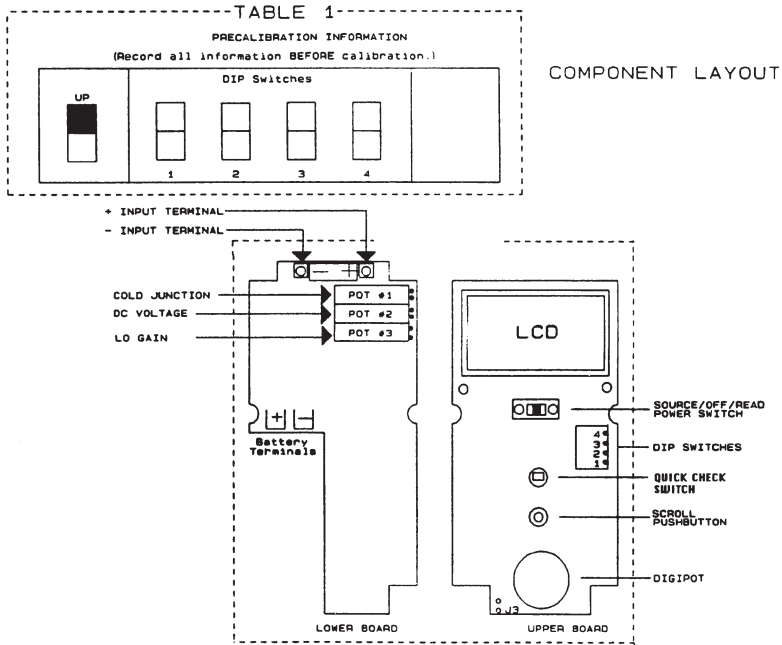


Figure 6-1. CL-307A Component Layout

6.4 Hi Gain

1. Set the millivolt source to 0.000mV.
2. Slide the CL-307A power switch to READ. Wait five minutes for the CL-307A to warm up.
3. The CL-307A should display 0.000 mV \pm 0.003mV.
4. Adjust the millivolt source to \pm 20.000 mV, the CL-307A should read 20.000 mV \pm 0.001 mV.
5. If the CL-307A does not read within 0.001 mV, adjust the DC mV calibration pot #2 so that the CL-307A reads within \pm 0.001 mV of 20.000 mV.
6. Flip dsw4 down for two or more seconds, then return it to the up position.
7. Readjust the DC mV calibration pot #2 if the CL-307A does not display 20.000 mV \pm 0.001 mV.

Dsw4 must be placed down for two or more seconds every time the DC mV calibration pot #2 is adjusted. This may have to be done a few times to get the CL-307A to read 20.000 mV \pm 0.001mV.

6.5 Lo Gain

1. Adjust the millivolt source to +77.600 mV.

The CL-307A should read $77.600 \text{ mV} \pm 0.009 \text{ mV}$. The least significant digit may be bouncy.

If the CL-307A does not read $77.600 \text{ mV} \pm 0.009 \text{ mV}$, adjust the Lo Gain pot #3 until it does.

2. Flip dsw4 down for two or more seconds, then return it to the up position.
3. Readjust the Lo Gain pot #3 if the CL-307A does not display $77.600 \text{ mV} \pm 0.009 \text{ mV}$.

Dsw4 must be placed down for two or more seconds every time the Lo Gain pot #3 is adjusted.

6.6 Check Linearity

1. Adjust the millivolt source to the following voltages and check to make sure the CL-307A is in tolerance at each voltage point.

Voltage	Tolerance	Voltage	Tolerance
-77.600 mV	$\pm 0.009 \text{ mV}$	0.000 mV	$\pm 0.004 \text{ mV}$
-60.000 mV	$\pm 0.008 \text{ mV}$	10.000 mV	$\pm 0.004 \text{ mV}$
-40.000 mV	$\pm 0.006 \text{ mV}$	40.000 mV	$\pm 0.006 \text{ mV}$
-10.000 mV	$\pm 0.004 \text{ mV}$	60.000 mV	$\pm 0.008 \text{ mV}$

2. Slide the CL-307A power switch to off and disconnect the mV source.

6.7 Cold Junction Calibration

1. Connect the NIST traceable thermocouple probe to the CL-307A input.
2. Place the thermocouple into the ice bath or ice point reference cell.
3. Place all DIP switches down and slide the CL-307A power switch to READ.
4. Wait approximately 10 minutes for temperature differences to settle.
5. Adjust the cold junction calibration pot #1 so that the CL-307A displays a temperature of 32.0°F (or a value that compensates correctly for any known inaccuracies of the thermocouple probe).
6. Wait ten seconds between adjustments to allow the CL-307 time to recalculate the cold junction compensation.
7. Slide the CL-307A power switch to OFF.

6.8 Read Mode Testing

1. Connect a known good thermocouple to the input of the CL-307A.
2. Place all DIP switches down and turn the unit on to READ. With the QUICK-CHECK switch in the READ position, push the RESET button to reset the MAX and MIN.
3. Expose the thermocouple to temperatures above and below room temperature (a hot and cold cup of water, over, refrigerator, etc.) and observe that the displayed temperature rises and falls.

6.8.1 MAX and MIN

1. Move the QUICK-CHECK switch to both the MAX and MIN position and observe that the higher temperature is stored in the MAX position, and the lower temperature is stored in MIN.
2. Press the RESET button with the QUICK-CHECK in READ position.
3. Move the QUICK-CHECK switch to READ, MAX and MIN temperatures and observe that all positions read the same temperature.
4. Turn the CL-307A off.

6.9 Source Mode Testing

6.9.1 Storing QUICK-CHECK Values

1. Turn the unit on to SOURCE.
2. With the QUICK-CHECK switch in the HI position, turn the knob clockwise and observe that the temperature on the display increases.
3. Continue turning the knob until an easily remembered value appears on the display (1000 for example), and press the STORE button to store the value. The display should flash once, indicating that the value is stored.
4. Move the QUICK-CHECK switch to the LO position.
5. Repeat the same procedure moving the knob counterclockwise to an easily remembered value (-100 for example), and press the STORE button. The display should flash once, indicating that the value is stored.

6.9.2 Recalling QUICK-CHECK Values

1. Turn the CL-307A off, then on in Source.
2. Move the QUICK-CHECK switch to the HI and LO positions, verifying that the CL-307A has recalled previously stored values.

The user's DIP switch positions should be restored at this time. Refer to Table 1 for the recorded positions.

If the unit should fail to meet any of its stated specifications after recalibration, contact the OMEGA Customer Service Department at 1-800-622-2378 or (203) 359-1660.

6.9.3 Ice Bath Construction

1. Prepare a Thermos (or equivalent vacuum insulated bottle) by drilling a hole in its cap to accept the thermocouple or use a standard laboratory cork.
2. Fill the Thermos with shaved or crushed ice made from distilled water.
3. Fill the Thermos with enough distilled water so that the ice becomes slush, but not enough to float the ice.
4. Replace the Thermos cap or cork and insert the thermocouple.

This page is intentionally blank.

7.1 Suggested Equipment

1. Precision millivolt source with accuracy of $\pm 0.004\%$ of source voltage $\pm 0.006\text{mV}$.
2. Precision digital voltmeter with accuracy of $\pm 0.004\%$ of reading ± 0.006 millivolts and a resolution of 0.01mV . OMEGA recommends a DMM with 6-1/2 digits or greater.

7.2 Precautions

1. Observe anti-static procedures.
2. It is recommended that the CL-307A be handled as little as possible during calibration to reduce errors. If the unit is held without its box, the heat from your body may cause uneven heating of temperature sensitive components.
3. Before any adjustments are made to the CL-307A, fresh batteries (9V alkaline) should be placed in the unit.

7.3 Calibration Procedure

Refer to Figure 7-1 for locations of the switches and the adjustment potentiometer. Allow one hour for the CL-307A to stabilize to the ambient temperature of the calibration room.

1. With the CL-307A in the off position, put all DIP switches up.
2. Connect the precision millivolt source, sourcing 0.00mV, to the CL-307A inputs, observing proper polarity.
3. Slide the CL-307A power switch to READ, then wait five minutes for it to warm up. The CL-307A should display 0.00mV \pm 0.01mV.
4. Adjust the millivolt source to \pm 999.70mV and flip dsw4 down for two seconds and then back up to the up position. The CL-307A should read 999.70mV \pm 0.08mV.
5. If the CL-307A does not read within \pm 0.08mV, adjust the DC mV calibration pot #1 until it does.
6. Flip dsw4 down for two or more seconds, then return it to the up position.
7. Readjust the DC mV calibration pot #1 if the CL-307A does not display 999.70mV \pm 0.08mV.

Dsw4 must be placed down for two or more seconds every time the DC mV calibration pot #1 is adjusted. This may have to be done a few times.

8. Adjust the millivolt source to the following voltages and check to make sure the CL-307A is in tolerance at each voltage point.

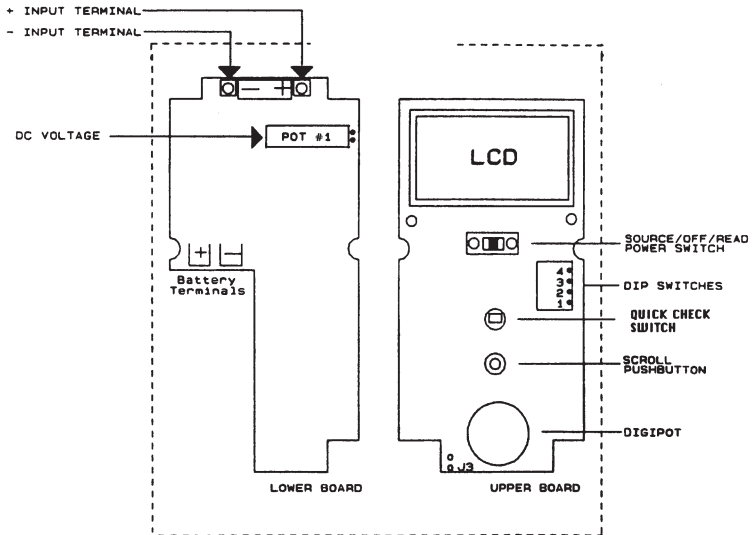


Figure 7-1. CL-307A-mV Component Layout

Voltage	Tolerance	Voltage	Tolerance
-999.70 mV	± 0.08 mV	0.00 mV	± 0.01 mV
-600.00 mV	± 0.05 mV	100.00 mV	± 0.01 mV
-400.00 mV	± 0.04 mV	400.00 mV	± 0.04 mV
-100.00 mV	± 0.01 mV	600.00 mV	± 0.05 mV

9. Slide the CL-307A power switch to off and disconnect mV source.

7.4 Functional Testing

7.4.1 Source Mode Accuracy

1. With the CL-307A-mV in the off position, put all DIP switches up.
2. Slide the CL-307A power switch to SOURCE.
3. Connect the precision digital voltmeter to the CL-307A outputs, observing proper polarity.
4. Turn the CL-307A to 999.70, 0.00, -999.70 mV and verify that the unit is within ± 0.08 mV at all three points.

7.4.2 Source Mode Quick-Check Test

1. With the CL-307A-mV in the off position, put all DIP switches down.
2. Slide the CL-307A power switch to SOURCE.

3. With the QUICK-CHECK switch in the HI position, turn the digital pot clockwise and observe that the voltage on the display increases. Observe that turning the knob faster causes the display to increase more rapidly. Continue turning the knob until an easily remembered value appears on the display (500 mV for example), and press the STORE button to store the value. The display should flash once, indicating that the value is stored.
4. Move the QUICK-CHECK switch to the LO position and turn the digital pot counterclockwise to an easily remembered value (-500 mV for example), and press the STORE button. The display should flash once indicating that the value is stored.
5. Turn the CL-307A off, then back on to SOURCE mode. Move the QUICK-CHECK switch to the HI and LO positions, verifying that the CL-307A-mV has recalled the previously stored values.
6. Slide the CL-307A power switch to off.

7.4.3 Read Mode Quick Check Test

1. Make sure all DIP switches are down, and slide the CL-307A power switch to Read.
2. Connect the precision millivolt source to the CL-307A input, observing proper polarity.

3. With the QUICK-CHECK switch in the READ position, push the RESET button to reset the MAX and MIN.
4. Adjust the mV source to a voltage higher than 0 mV and then to a voltage lower than 0 mV.
5. Move the QUICK-CHECK switch to both the MAX and MIN position, and observe that the higher voltage is stored in the MAX position, while the lower voltage is stored in the MIN position.
6. Press the RESET button with the QUICK-CHECK switch in the READ position to clear the MAX and MIN values. Verify that the max and min values have been cleared by moving the QUICK-CHECK switch to the READ, MAX, and MIN positions and observing that all three positions read the same voltage (the voltage that the mV source is currently sourcing).
7. Turn the CL-307A off.

After all tests have been made, make sure all DIP switches are down.

If the unit should fail to meet any of its stated specifications after recalibration, contact the OMEGA Customer Service Department at 1-800-622-2378 or (203) 359-1660.

General

General Accuracy:	$\pm 0.016\%$ of reading $+0.006$ millivolts
Thermocouple:	$\pm 0.012\%$ of 156 millivolt span @ 25°C
Millivolt:	$\pm 0.0083\%$ of 2000 millivolt span @ 25°C
Cold Junction Compensation:	Built-in for specified thermocouple type, characterized to T/C curve
Cold Junction Temperature Effect:	Within 0.05° per $^{\circ}\text{C}$ change in ambient temperature over operating range
Operating Temperature Range:	-5 to $+140^{\circ}\text{F}$ (-20 to $+60^{\circ}\text{C}$)
Storage Temperature Range:	-22 to $+175^{\circ}\text{F}$ (-30 to $+80^{\circ}\text{C}$)
Relative Humidity:	10 to 90%, non-condensing
Zero Stability:	Included in cold junction effect
Warm-up Time:	1 minute to full rated accuracy
Overload Protection:	120 volts AC/DC for 30 seconds on connecting leads, in any mode
Battery Life:	9 volts alkaline: 40 hours
Low Battery:	"BAT" indication on LCD at 7 volts nominal, approximately 10 hours left
Reference Drift:	<20 ppm/ $^{\circ}\text{C}$

Overall Size:	2-1/2" x 2-5/8" x 5-1/8" 63.5 x 66.7 x 130 mm
Weight:	10.9 oz. (0.31 kg)
Carrying Case:	Included, zippered with belt loop and shoulder strap

Source Mode

Output Impedance:	<0.1 ohms
Source Current:	Up to 8 mA (drives 80 mV into 10 ohms)
Output Noise:	<4 microvolts for frequencies of 10Hz or below
Overload:	Indicates OVER and blanks digits on display

Read Mode

Input Impedance:	>10 megohms
Open Thermocouple Detection:	450 millisecond check pulse. Nominal threshold, 10K ohms. Displays "----" for open circuit.
Normal Mode Rejection:	50/60 Hz, 50 dB
Common Mode Rejection:	50/60 Hz, 120 dB

Input Ranges, Resolutions and Accuracies*

Thermocouple Input Models

Model	Input Type	°C Range	Accuracy	°F Range	Accuracy	T/C Material
CL-307A-J	J	360 to 1200 -129.9 to 359.9 -210 to -130	±0.3 ±0.2 ±0.4°	680 to 2192 -201.9 to 679.9 -346 to -202	±0.5° ±0.4 ±0.7	+Iron -Constantan
CL-307A-K	K	500 to 1371 -49.9 to 499.9 -200 to -50 -237 to -200	±0.4 ±0.2 ±0.4 ±1.8°	932 to 2500 -57.9 to 931.9 -328 to -58 -395 to -328	±0.8° ±0.4 ±0.8 ±3.3	+ Chromel -Alumell
CL-307A-T	T	-29.9 to 400.0 -220 to -30 -260 to -220	±0.2 ±0.5 ±1.8°	-21.9 to 752.0 -364 to -22 -436 to -364	±0.3° ±1.0 ±3.2	+Copper -Constantan
CL-307A-E	E	280 to 1000 -149.9 to 279.9 -230 to -150 -243 to -230	±0.2 ±0.2 ±0.5 ±1.9°	536 to 1832 -237.9 to 535.9 -382 to -238 -405 to -382	±0.4° ±0.3 ±0.8 ±3.5	+Chromel -Constantan
CL-307A-R	R	150 to 1768 0 to 150 -50 to 0	±0.7 ±1.1 ±1.6°	302 to 3214 32 to 302 -58 to 32	±1.3° ±2.0 ±2.9	+Pt/13Rh -Platinum
CL-307A-S	S	1650 to 1768 200 to 1650 0 to 200 -50 to 0	±0.8 ±0.7 ±1.1 ±1.5°	3002 to 3214 392 to 3002 32 to 392 -58 to 32	±1.5° ±1.3 ±2.0 ±2.7	+Pt/10Rh -Platinum

*Based on $\pm(0.016\% \text{ of Reading} + 0.006 \text{ millivolts})$

Input Ranges, Resolutions and Accuracies (continued)**Millivolt Input Model**

Model	Range	Accuracy	Resolution
CL-307A-mV	-999.9 to 100.0 mV	±0.016% of reading	10 µV
	-99.99 to +99.99	+0.006 millivolts	1 µV
	100.0 to 999.9		10 µV

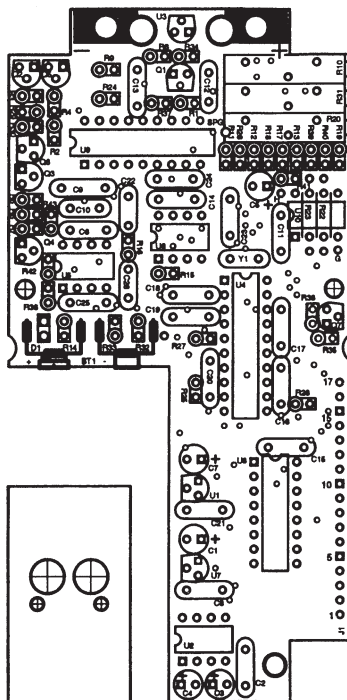


Figure 8-1. Analog PCB Component Layout

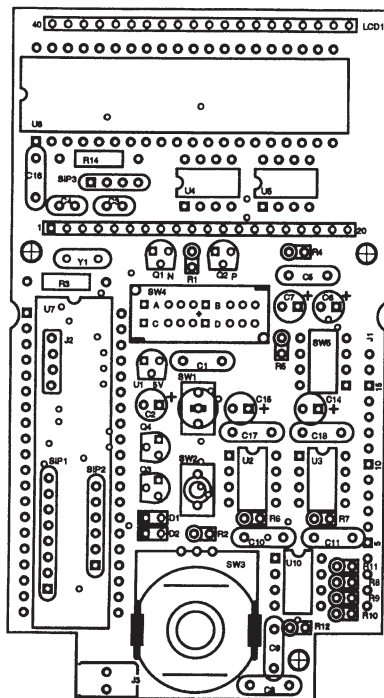


Figure 8-2. Digital PCB Component Layout

NOTES

NOTES



WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **37 months** from date of purchase. OMEGA's Warranty adds an additional one (1) month grace period to the normal **three (3) 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 which wear are not warranted, including but 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 it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS 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.

© Copyright 2003 OMEGA ENGINEERING, INC. All rights reserved. This document may not be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form, in whole or in part, without the prior written consent of OMEGA ENGINEERING, INC.

Where Do I Find Everything I Need for Process Measurement and Control? **OMEGA...Of Course!**

Shop online at www.omega.com

TEMPERATURE

- ☑ Thermocouple, RTD & Thermistor
Probes, Connectors, Panels & Assemblies
- ☑ 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