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CL130
Thermocouple Calibrator
J, K, E, T, N, R, S, B,
and mV



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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.

THERMOCOUPLE CALIBRATOR USER MANUAL



The T/C calibrator is a handheld unit for thermocouple (T/C) measurement or simulation. Eight T/C types are supported referencing NIST175 and ITS90 standards. Temperature can be displayed in selectable engineering units of °C, °F, °R, K and mV.

Table of Contents

Introduction	3
User Interface.....	4
Keypad Functions	4
ON/OFF Key	4
BACKLIGHT Key.....	4
SETUP Key	4
FUNCTION Key	5
UNITS Key.....	5
ENTER Key.....	5
INCREMENT (+) Group Keys.....	5
DECREMENT (-) Group Keys	6
Liquid Crystal Display (LCD)	6
Functional Modes and States	7
T/C Measurement	8
T/C Simulation (Manual).....	8
T/C Simulation (Auto).....	8
MEAS SETUP	9
SIM (MANUAL) SETUP.....	10
SIM (AUTO) SETUP	11
Engineering Units Select	13
Record Mode	13
OFF Timer	14
Zeroing.....	14
Specifications.....	15
T/C Measurement & Simulation Accuracy Table.....	16
Certification	17
Changing the Batteries.....	17
User Connections.....	18
Contact Information.....	18

Introduction

The Thermocouple (T/C) calibrator has been designed using the latest technology to provide reliable accuracy throughout its entire operating temperature range, dependable operation, and exceptional battery life.

The compact design makes the unit easy to carry and the intuitive user interface makes it easy to use.

Temperature measurements/simulations are displayed on a large, easy-to-read liquid crystal display (LCD). This unit has two backlights: a green backlight which is user activated to improve readability in low light conditions, and an automatic red backlight which indicates an over-range condition.

Twelve keys provide access to the functional modes and menus, including Measure, Simulate, Setup, Run, Record, Edit, and Backlight activation. A list of these functions is printed on the back of the case.

User Interface

Keypad Functions

ON/OFF Key



The ON/OFF key, represented by the standard ON/OFF symbol, turns the unit ON or OFF (note: the ON/OFF key must be held until the display turns on or off). Upon power on, the unit will perform a self-test, displaying all segments for approximately 1-2 seconds, then go into the mode in use when unit was powered off. The firmware version is displayed at the end of the self-test.

BACKLIGHT Key



The BACKLIGHT key, represented by the standard light-bulb symbol, turns the green display backlight on and off. The backlight will remain on for approximately 20 seconds if not manually turned off. To override the auto shut off timer, press and hold the BACKLIGHT key to turn the backlight on. After holding the key for approximately 2 seconds, the backlight will flash off and back on. Release the key now and the backlight will remain on until manually turned off or until power is cycled.

SETUP Key



The SETUP key enters or exits the setup mode and is also used to go back one menu level. The SETUP icon is displayed while in the setup mode. Setup menus are shown in the bottom (alpha-numeric) row of the LCD. The SETUP key also ends simulation activities.

FUNCTION Key



The FUNCTION key, represented by the FUNC symbol, selects one of 3 functional modes: Measure, Simulate (manual), or Simulate (auto), and displays the corresponding icons (MEAS, SIM). This key can also be used to advance one menu item or will advance to next recorded value while in RECORD view mode.

UNITS Key



The UNITS key selects the engineering unit of measurement/simulation desired for temperature probes: °F, °C, °R, and K. The UNITS function is only available when the unit is actively measuring or simulating temperature signals. This key is also used to go back one menu item in SETUP or back to the previous recorded value while in VIEW mode.

ENTER Key



The ENTER key accepts the currently displayed item/value during setup activities. During active simulation activity, the ENTER key toggles between T/C type with temperature unit information and % of range.

INCREMENT (+) Group Keys



The three keys beneath this symbol allow the user to scroll through edit selections when EDIT icon is lit. The keys are also used to increment numeric values. For this function, the narrow band signifies fine adjustment, the medium band signifies medium adjustment, and the wide band signifies coarse adjustment for changing the values. The positive sign (+) indicates the Group Keys will increment the displayed value.

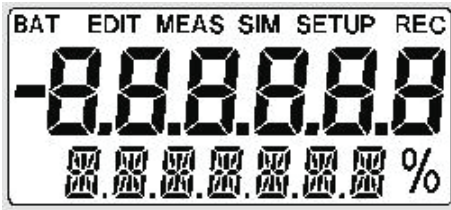
DECREMENT (-) Group Keys



The three keys beneath this symbol allow the user to scroll through edit selections when EDIT icon is lit. The keys are also used to decrement numeric simulation values. For this function, the narrow band signifies fine adjustment, the medium band signifies medium adjustment, and the wide band signifies coarse adjustment for changing the values. The negative sign (-) indicates the Group Keys will decrement the displayed value.

In addition, when the narrow band and wide band areas are pressed simultaneously (HOME) the unit will return to the Measure mode default position.

Liquid Crvstal Display (LCD)



- ← Mode icons
- ← Measure or Simulate Values
- ← Menus, units or other information

The LCD displays:

- current Functional Mode and/or state via icons along top of display
- primary measurements via the large middle segments
- menu items and additional information via the bottom alpha-numeric segments

The LCD incorporates two backlights:

- a green backlight which is user activated via the BACKLIGHT key
- a red backlight which is automatically activated during an over-range/under-range condition.

During an over-range/under-range condition, the red backlight will over-ride the green backlight if it was already on. Once the condition is corrected, the green backlight will be restored to its previous state (assuming the backlight auto-off timer did not expire).

- Notes:
1. The backlight should be turned off when not needed to conserve battery power.
 2. The backlight will be automatically disabled when the unit reaches battery mode.

Functional Modes and States

The unit supports measurement and simulation activities using the following

Functional Modes:

1. Measure - temperature units or measure mV; MEAS icon shown at top of display
2. Simulate, Manual - simulate fixed values of temperature units or mV; SIM icon shown at top of display
3. Simulate, Auto - simulate step or ramp output functions in temperature units or mV; SIM icon shown at top of display

Each Functional Mode has three possible **States**:

1. Run - active measurement or simulation; MEAS or SIM icon shown at top of display
2. Setup – access navigation menus; MEAS & SETUP or SIM & SETUP icons shown at top of display
3. Edit Setup - edit a parameter within a navigation menu; “EDIT, MEAS & SETUP” or “EDIT, SIM & SETUP” icons shown at top of display

The T/C calibrator will power up in its previous functional mode when turned ON. Example: if previous use was SIM (Auto), then next power up will default to SIM (Auto). Simulation will restart when user confirms the desired setup and presses the ENTER key (two times).

See the table below for functional modes, states and key functions.

FUNCTIONAL MODES, STATES, AND KEY FUNCTIONS			
Keys	Run	Setup	Edit Setup
	MEAS or SIM	MEAS SETUP or SIM SETUP	EDIT MEAS SETUP, or EDIT SIM SETUP
SETUP	Enters Setup state, or ends simulation activity	Back one menu level, or exits Setup state	Discards changes and exits Edit Setup state
FUNC ►	Next Functional mode	Next menu item	---
◀ UNITS	Next engineering unit	Previous menu item	---
ENTER	Toggles lower display line between TC type / temp. unit and % of range (SIM only)	Selects menu item	Saves changes and exits Edit Setup state
Increment (+) Group	MEAS: --- SIM Manual: Change values	---	Change value
Decrement (-) Group	MEAS: --- SIM Manual: Change values	---	Change value

T/C Measurement

- When the T/C calibrator is turned on the display defaults to the previous mode it was in with the previous T/C type and Unit. To change the mode press the FUNC ► key until the Measure mode is obtained. Once in Measure mode, press the ◀ UNITS key until the desired unit is obtained.
- Press the SETUP key to enter the initial setup menu for the current functional mode. To go back one menu item press the ◀ UNITS key. To advance the menu, press the FUNC ► key. SETUP key also backs out of the Setup state and returns to the Measure mode.
- ENTER key accepts the menu item to edit and saves the selection. During the SETUP EDIT state the ◀ UNITS key goes back one increment value, and the FUNC ► key advances one increment value.
- T/C measurements can be recorded to memory either manually or automatically. See the Record Mode section of this manual for more information.
- When an over-range/under-range message is displayed, the unit is measuring values outside the specified range for a particular T/C type (See the T/C Measurement Accuracy Table for specified ranges). The red backlight will illuminate and “----” will be displayed.
- If a thermocouple has not been connected to the unit “T/C OPEN” will be displayed.

T/C Simulation (Manual)

- When unit is turned on the display defaults to the previous mode with the last T/C type and Units chosen. To enter the Simulation Manual mode press the FUNC ► key until SIM MANUAL appears, then press the SETUP key.

T/C Simulation (Auto)

- When unit is turned on the display defaults to the previous mode with the last T/C type and Units chosen. To enter the Simulation Auto mode press the FUNC ► key until SIM AUTO appears, then press the SETUP key.

MEAS SETUP: Measure Mode Setup menu structure

T/C TYPE	select ENTER to access submenus
mV	engineering units are mV
B	engineering units are temperature only
E	engineering units are temperature only
J	engineering units are temperature only
K	engineering units are temperature only
N	engineering units are temperature only
R	engineering units are temperature only
S	engineering units are temperature only
T	engineering units are temperature only
OFF TMR	select ENTER to access submenus
30 MIN	shuts off in 30 min without new key stroke
OFF	must use ON/OFF key to shut off
F RECAL	select ENTER to access submenu
ZERO	set zero. See the “Zeroing” section
VIEW	view previously recorded values
RECORD	select ENTER to access submenus
MANUAL	press ENTER button to record values
AUTO	values automatically recorded every 5 seconds

Note: Main and submenus are continuous scrolling menus. Use ◀ or ▶ to scroll through the menus.

SIM (MANUAL) SETUP: Simulation Mode's Manual menu structure

VALUE

ADJUST	Press ENTER & use increment or decrement group keys to set a numeric value, press ENTER to start
UNITS	Select desired unit of simulation
C	engineering units are °C
F	engineering units are °F
R	engineering units are °R
K	engineering units are K
TC TYPE	Select T/C type or mV
mV	engineering units are mV
B	engineering units are temperature only
E	engineering units are temperature only
J	engineering units are temperature only
K	engineering units are temperature only
N	engineering units are temperature only
R	engineering units are temperature only
S	engineering units are temperature only
T	engineering units are temperature only

0 – 100

	Outputs 0% and 100% of setup
START	Starts 0% of range; ENTER toggles to 100%, 0%...
UNITS	Edit units corresponding to 0 – 100, same as above
TC TYPE	Select T/C type, same as above
URV	Upper Range Value for T/C and unit selected press enter & use +/- keys
LRV	Lower Range Value for T/C and unit selected press enter & use +/- keys

STEP 25%

	Outputs 0, 25, 50, 75 and 100% of setup below
START	Starts 0%, ENTER increases 25% to 100% & back
UNITS	Edit unit for STEP 25%, same as above
TC	Select T/C type, same as above
URV	Upper Range Value for T/C and unit selected press enter & use +/- keys
LRV	Lower Range Value for T/C and unit selected press enter & use +/- keys

- Notes: 1. Main and submenus are continuous, scrolling menus. Use ◀ or ▶ to scroll through the menus.
2. Use SETUP key to discontinue simulation activity.

SIM (AUTO) SETUP: Simulation Mode's Manual menu structure

AUTO	Press SETUP to enter
A.STEP 1	Title of Auto Step 1 simulation; setup saved here for subsequent re-use
START	Starts A.STEP 1
UNITS	Select desired unit of simulation
C	engineering units are °C
F	engineering units are °F
R	engineering units are °R
K	engineering units are K
TC TYPE	Select T/C type or mV
mV	engineering units are mV only
B	engineering units are temperature only
E	engineering units are temperature only
J	engineering units are temperature only
K	engineering units are temperature only
N	engineering units are temperature only
R	engineering units are temperature only
S	engineering units are temperature only
T	engineering units are temperature only
URV	Upper Range Value for T/C and unit selected, press enter & use +/ – keys
LRV	Lower Range Value for T/C and unit selected, press enter & use +/ – keys
STEPS	Input number of steps desired for test
UP	press enter & use +/ – keys
DOWN	press enter & use +/ – keys
DWELL	Select desired dwell time for test points
Manual	Manually advance simulation
5 SEC.	Auto advance simulation every 5 seconds
10 SEC.	Auto advance simulation every 10 seconds
A.STEP 2	same as A.STEP 1 above
A.STEP 3	same as A.STEP 1 above
A.RAMP 1	Title of Auto Ramp 1 simulation; setup saved here for subsequent re-use
START	Starts A.RAMP 1
UNITS	Select desired unit of simulation
C	engineering units are °C
F	engineering units are °F
R	engineering units are °R
K	engineering units are K
TC TYPE	Select T/C type or mV
mV	engineering units are mV only
B	engineering units are temperature only
E	engineering units are temperature only
J	engineering units are temperature only
K	engineering units are temperature only
N	engineering units are temperature only

R	engineering units are temperature only
S	engineering units are temperature only
T	engineering units are temperature only
URV	Upper Range Value for T/C and unit selected, press enter & use +/- keys
LRV	Lower Range Value for T/C and unit selected, press enter & use +/- keys
UP TIME	Select desired ramp time from LRV to URV, press enter & use +/- keys
DN TIME	Select desired ramp time from URV to LRV, press enter & use +/- keys
DELAY	Select desired start delay time for test, press enter & use +/- keys

A.RAMP 2

same as A.RAMP 1 above

A. RAMP 3

same as A.RAMP 1 above

- Note:
1. Main and submenus are continuous, scrolling menus. Use ◀ or ▶ to scroll through the menus.
 2. Use SETUP key to discontinue simulation activity.

Engineering Units Select

Engineering Units are conveniently selected when actively measuring or in Manual Simulation mode. Press the ◀ UNITS key to display any of the following: °C, °F, °R, K. NOTE: to display mV units, select the mV option under MEAS SETUP / TC TYPE. The ◀ UNITS key will not change display units for this TC TYPE.

Record Mode

The T/C calibrator can store up to 240 temperature measurements in a single record (REC) session. For maximum flexibility, a REC session can be:

- Automatic - the current value is automatically stored every 5 seconds, for up to 20 minutes.
- Manual - the current value is stored every time the Enter key is pressed, up to 240 times.

Both types of REC sessions can store between 1 and 240 measurements. The measurement data is preserved in non-volatile memory until another REC session is started.

RECORD Data:

To start a **manual** record session from Measure Mode, press SETUP key and then ◀ or ▶ key until RECORD is displayed. Press ENTER and then ◀ or ▶ key until MANUAL is displayed. Press ENTER. Previously stored information is deleted and the unit enters Record Manual Mode. The REC icon flashes in upper right. Press Enter to save a displayed value to memory. Pressing SETUP key ends the session.

To start an **automatic** record session from Measure Mode, press SETUP key and then ◀ or ▶ key until RECORD is displayed. Press ENTER and then ◀ or ▶ key until AUTO is displayed. Press ENTER. Previously stored information is deleted and the unit enters Record Auto Mode. The REC icon flashes in upper right. Values are stored every 5 seconds until the SETUP key is pressed to end the session or 240 values are saved.

REC is displayed on the lower display line each time a sample is stored. After 240 measurements have been recorded or the SETUP key is pressed, the REC session will stop and the RECORD Data mode will automatically exit to Measure Mode.

VIEW Recorded Data:

To view the results of a REC session from Measure Mode, press SETUP key and then ◀ or ▶ key until VIEW is displayed. Press ENTER. The REC icon is shown in upper right. Display will show recorded value 1 of X (1/X). Pressing ENTER will toggle to show the T/C type and engineering unit. The ◀ or ▶ key moves to previous or next recorded value, respectively.

OFF Timer

To help conserve battery life, the unit can be programmed to shut off automatically after 30 minutes of keypad inactivity. From Measure Mode, press SETUP and then ◀ or ▶ key until OFF TMR is displayed. Press the ENTER key and use + or – key to display OFF or 30 MIN from menu. Press ENTER key to save selection. Press SETUP again to return to Measure Mode.

Zeroing

Preparation: Allow the T/C calibrator and supplied Shorting Plug (p/n Z9A83) to soak at room temperature for 30 minutes in a controlled temperature environment. Record the room temperature immediately prior to zeroing.

Zeroing: From Measure Mode, press SETUP once and then the ◀ or ▶ key until F RECAL is displayed. Press the ENTER key to display ZERO. Press ENTER to start ZERO process. Display will show SHORT. Install the Shorting Plug (white, mini-T/C connector with internal copper short) on the unit's mini-T/C connection and press ENTER key. Display will show BUSY.

When ZERO is successfully completed, the message “ZERO PASSED” is briefly displayed and the unit is automatically returned to the Measure Mode. Remove the Shorting Plug. The new temperature reference for the unit will be the ambient temperature recorded prior to zeroing. (Note: factory reference temperature is 23°C.)

If the ZERO is unsuccessful, the message “ZERO FAILED” will be displayed briefly. In this case, check to be sure the Shorting Plug is properly installed and repeat the ZERO process. If “ZERO FAILED” appears again contact your supplier for technical support.

Specifications

Type and Range: T/C types B, E, J, K, N, R, S, T & milli-volts Milli-volts range -15mV to +80.00 mV
T/C Measurement & Simulation Accuracy: See Table below mV Accuracy: 0.005% of reading $\pm 6\mu\text{V}$ mV Temp. Effect: $\pm 2\mu\text{V}/^\circ\text{C}$ (Factory Ref. Temp. = 23°C) Cold Junction Effect: $\pm 0.05^\circ\text{C}/^\circ\text{C}$ Cold Junction Accuracy: $\pm 0.1^\circ\text{C}$ at 25°C
T/C Resolution: T/C types E, J, K, N, T: 0.1°C T/C types B, R, S: 1°C mV: 0.001 mV (1 μV)
Temperature: Storage = -40°C to +85°C (-40°F to +185°F) Operating = -10°C to +50°C (14°F to +122°F)
Humidity: 10% to 90% Rh
Connection: Measure: standard mini-T/C connector Simulate: standard mini-T/C connector Zero: supplied mini-T/C connector with internal copper short
Maximum Input Voltage: 30VDC
Battery Type: 3 x AA battery, field replaceable.
Battery Operation: >100 hours continuous use without the backlight for measure or simulation modes, 1 year shelf life, low battery warning at approximately 2 hours remaining run time.
Enclosure: (6.5" \square 3.2" \square 1.1") Polycarbonate, Permanently Static Dissipative, ESD Protection Enclosure with Boot: (6.8" \square 3.5" \square 1.3")

T/C Measurement & Simulation Accuracy Table*

Find T/C type in left column and follow the row across to the temperature range of interest. Then follow the column up to determine the potential error in degrees C.

T/C Type	±3.0° C	±2.0° C	±1.0° C	±0.5° C	±0.4° C	±0.3° C	±0.2° C	±0.1° C
E						-200 to -179°C	-179 to 15°C	15 to 1000°C
J						-200 to -165°C	-165 to 1200°C	
K					-200 to 1372°C			
N						-200 to 110°C	110 to 1300°C	
T					-200 to -168°C	-168 to -86°C	-86 to 346°C	346 to 400°C
R		-50 to 27°C	27 to 736°C	736 to 1768°C				
S		-50 to 25°C	25 to 1179°C	1179 to 1768°C				
B	250 to 295°C	295 to 605°C	605 to 1301°C	1301 to 1820°C				

- *Notes: 1. Accuracy stated above applies to all T/C measurements and all manual (non-ramp) T/C simulations.
2. Cold junction effect at 25° C included in above table.

Certification

The T/C calibrator is EMI/ESD compliant to the test specification EN61326. The unit is for general purpose use only. Do not use in potentially hazardous atmospheres.

Changing the Batteries

The T/C calibrator is powered by three, 1.5 volt AA size batteries. The “BAT” icon in upper left of display will activate when battery output drops below a threshold level. Approximately 2 hours of life remain from that point.

Replace all three AA batteries at the same time for best performance.

To replace the batteries, locate the battery compartment at the lower rear of the unit. Remove the screws located at the top center and bottom center of the battery cover by turning them counterclockwise until fully disengaged from the base. Remove the cover. **Do not remove the pink anti-static foam that is attached to the inside of the battery cover. This foam is necessary to properly secure the batteries under specified shock and vibration conditions.**

Remove the batteries by pulling the positive side first straight out of the battery compartment. Note the positive (+) and negative (–) battery polarity markings at the bottom of the compartment, as shown below.



Install the three batteries by sliding them into the bottom of the battery slots, positive (+) end first, making sure the polarity markings on the batteries align with the markings molded into the battery compartment. When a battery is installed with the polarity reversed, the stand-offs prevent the negative battery terminal from contacting the positive terminal in the battery compartment. The unit will not power up in this condition; to correct, simply reverse the battery to correct the polarity.

With the batteries secured in the battery compartment, replace the compartment cover. The cover has only one orientation for correct alignment. The “WARNING DO NOT OPEN IN EXPLOSIVE ATMOSPHERE” statement on the battery cover must be visible and aligned in the approximate middle of the case. To secure the cover, torque the screws clockwise to 1.6 in-lbs. Do not over tighten.

User Connections

Connection: Standard mini-T/C Connector (Measure and Simulate)

Warning: The copper receiver blades of the mini-T/C connector can be damaged if the mating plugs are misaligned during installation. Take care to properly align the mating plug prior to pressing it into the calibrator's mini-T/C jack.



Contact Information

If the unit is damaged, it should be returned to the factory for service. In this case, contact your supplier for a return number.



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.

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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.

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