



eC370T
Volt/mA/Thermocouple
Calibrator

User Manual

ennoLogic eC370T Volt/mA/Thermocouple Calibrator

Made in China

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1. GENERAL INSTRUCTIONS

1.1 Precautionary Safety Measures

Important Note: Limited Liability

Cascadia Innovations is the exclusive distributor of all ennoLogic® products. Except as explicitly stated, Cascadia Innovations is not liable for direct, indirect, incidental, or other types of damages arising out of, or resulting from the use of this product. By using the eC370T you agree to hold ennoLogic® and Cascadia Innovations harmless for any and all consequences of the use of this instrument or application of data from the use of this instrument.

To avoid possible electric shock or personal injury:

- Never apply more than 30V between any two terminals, or between any terminal and earth ground.
- Make sure the battery door is closed and latched before you operate the instrument.
- Remove test leads from the calibrator before you open the battery door.
- Do not operate instrument if it appears to be damaged.

- Do not operate the calibrator around explosive gases, vapor, or dust.

To avoid possible damage to the calibrator:

- Make sure you choose the correct terminals and settings before using the calibrator for measurements or calibrations.
- Disconnect and remove the calibrator from the equipment or circuit under test after the testing has been completed.

1.2 Introduction

The ennoLogic Volt/mA Calibrator eC370T is a tool for sourcing and measuring voltages and mA currents and for testing and simulating thermocouples. It can measure or output DC currents in the range of 0 to 24 mA, and DC voltages from 0 to 20 V. It can measure thermocouple temperatures as well as simulate a thermocouple at a desired temperature. The calibrator also has a built-in 24V loop power supply.

Please note that this instrument cannot be used to measure and source signals simultaneously.

The following table summarizes the functions and technical specifications of the calibrator eC370T.

1.2.1 Measurement and Output of Voltages

Function	Range	Resolution
DC V and mV Input	0 ~ 100 mV	0.01 mV
	0 ~ 20 V	0.001 V
DC V and mV Output	0 ~ 100 mV	0.01 mV
	0 ~ 20 V	0.001 V
Loop Power Output	24V DC	N/A

1.2.2 Measurement and Output of mA Currents







Function	Range	Resolution
DC mA Input	0 ~ 24 mA	0.001 mA
DC mA Output	0 ~ 24 mA	0.001 mA

1.2.3 Measurement and Output of Temperatures

Thermocouple	Range	Resolution
K (CA)	-200.0°C ~ +1370.0°C	0.1 °C
J (IC)	-200.0°C ~ +1200.0°C	0.1 °C
E (CRC)	-200.0°C ~ +1000.0°C	0.1 °C
T (CC)	-200.0°C ~ +400.0°C	0.1 °C
N	-250.0°C ~ +1300.0°C	0.1 °C
S (PR10)	-20°C ~ +1750°C	1 °C
R (PR13)	-20°C ~ +1750°C	1 °C
B (PR30)	+600°C ~ +1800°C	1 °C

1.3 Symbols

The following is a list of symbols used in this manual and on the instrument:

	Caution: Incorrect use may result in damage to the device or its components. Please refer to the user manual.
	AC (Alternating Current)
	DC (Direct Current)
	AC or DC
	Earth Ground
	Conforms to European Union directives

1.4 General Instructions

- Remove the test leads from the instrument before opening the instrument's battery cover or case.
- Before opening the instrument, always disconnect it from all power sources and make sure your body is not electrostatically charged, which may destroy internal components.
- Any adjustments, maintenance or repair work carried out on the calibrator while it is operating should be carried out only by qualified

personnel, and after reviewing the instructions in this manual.

- A "qualified person" is someone who is familiar with the installation, construction and operation of the equipment and the hazards involved. This person is trained and authorized to energize and de-energize circuits and equipment in accordance with established practices.
- When the instrument is opened up, remember that some internal capacitors can retain a dangerous potential even after the instrument has been turned off.
- If any faults or abnormalities are observed, take the instrument out of service and ensure that it cannot be used until it has been checked out.
- If the meter is not going to be used for a long time, remove the batteries and do not store the instrument at high temperatures or in high humidity environments.

2. INSTRUMENT DESCRIPTION

2.1 Main User Elements

The front panel is shown in Figure 2-1, and its user elements are described below:

1. Loop power terminal (24V)
2. mA measurement input terminal
3. COM terminal (ground/negative) for input and output
4. V / mV terminal for input and output
5. Power On/Off button
6. V / mV toggle switch
7. mA / mA% toggle switch
8. Thermocouple type selector
9. Temperature unit selector
10. Input / Output toggle switch
11. Ladder / Ramp output key, also Minus input key (press and hold for 2 seconds)
12. Decimal point key
13. Enter key
14. Increment key
15. Decrement key
16. Thermocouple mini jack

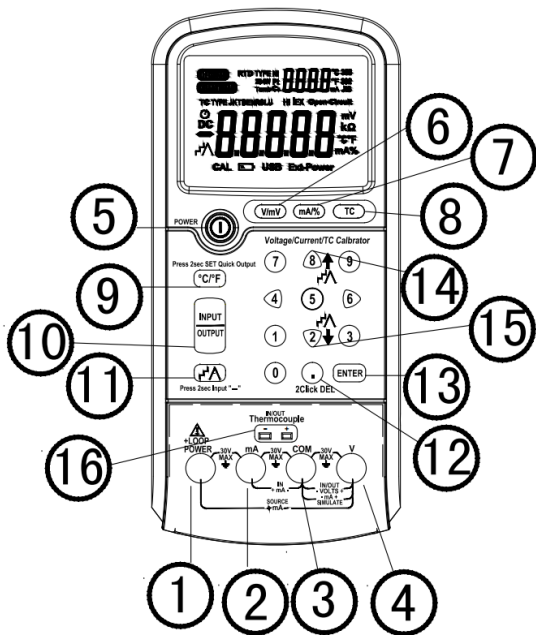


Figure 2-1: Calibrator Front Panel

2.2 LCD Display

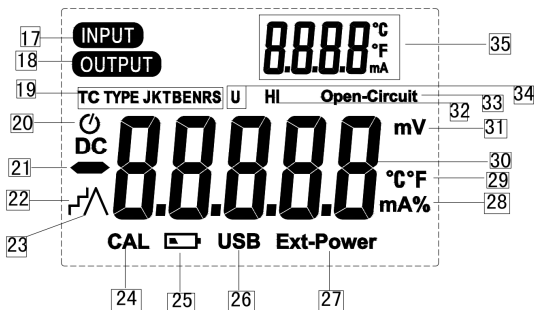


Figure 2-2: LCD Display









The LCD display is shown in Figure 2-2 above, and the symbols are explained below:


17. Input mode indicator
18. Output mode indicator
19. Thermocouple type indicator
20. Auto Power Off enabled indicator
21. Minus sign
22. Ladder output indicator
23. Ramp output indicator
24. Calibration mode indicator

- 25. Low battery indicator
- 26. USB indicator
- 27. External power indicator
- 28. Current mA/mA% indicator
- 29. Centigrade / Fahrenheit indicator
- 30. Measurement value or output value
- 31. Voltage V/mV indicator
- 32. High indicator
- 33. Open-circuit indicator
- 34. Output unstable indicator
- 35. Secondary display area

3. FUNCTION DESCRIPTIONS

3.1 DC Voltage Measurement

- ① Press the power button  to turn on the calibrator*.
- ② Press the input / output toggle switch  until the display shows the input mode indicator . This will set the instrument to measurement (input) mode as opposed to output mode.
- ③ Press the V/ mV toggle switch  to select the desired measurement range (volt or millivolt, indicated by the V/mV indicator ).
- ④ Connect the red test lead to the V terminal , and the black test lead to the COM terminal .
- ⑤ Connect the test leads/probes to the circuit or equipment to be measured.
- ⑥ Read the displayed voltage value .

* The numbers in the  refer to the descriptions of the main user elements and LCD symbols explained in the previous two sections 2.1 and 2.2.

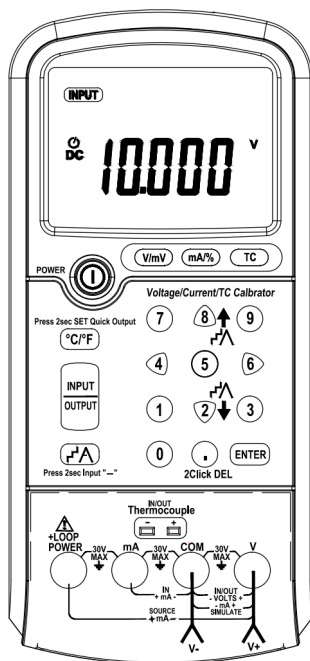


Figure 3-1: DC Voltage Measurement

3.2 DC Voltage Output

- ① Press the power button **5** to turn on the calibrator.
- ② Press the input / output toggle switch 10 until the display shows the output mode indicator **18**. This will set the instrument to output mode as opposed to measurement (input) mode.
- ③ Press the V/ mV toggle switch **6** to select the desired output range (volt or millivolt, indicated by the V/mV indicator **31**).
- ④ Press the numeric keys to set the output voltage to the desired value, then press the Enter key **13**. If you entered an incorrect value, briefly-press the Decimal point key **12** twice to clear your input.
- ⑤ Connect the red test lead to the V terminal **4**, and the black test lead to the COM terminal **3**.
- ⑥ Connect the test leads/probes to the circuit or equipment to be tested.

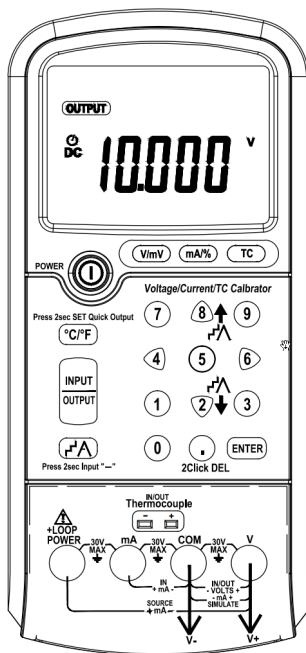


Figure 3-2: DC Voltage Output

3.3 DC mA Current Measurement

3.3.1 Current Measurement of Circuits Powered by an External Power Supply

- ① Press the power button **5** to turn on the calibrator.
- ② Press the input / output toggle switch **10** until the display shows the input mode indicator **17**. This will set the instrument to measurement (input) mode.
- ③ Press the mA / mA% toggle switch **7** to select either mA or mA% display **28**. If mA% is selected, the “4-20mA” symbol will be displayed in the secondary display area **35**.
- ④ Connect the red test lead to the mA terminal **2**, and the black test lead to the COM terminal **3**.
- ⑤ Connect the test leads/probes to the circuit or equipment to be measured.
- ⑥ Read the displayed current value **30**.

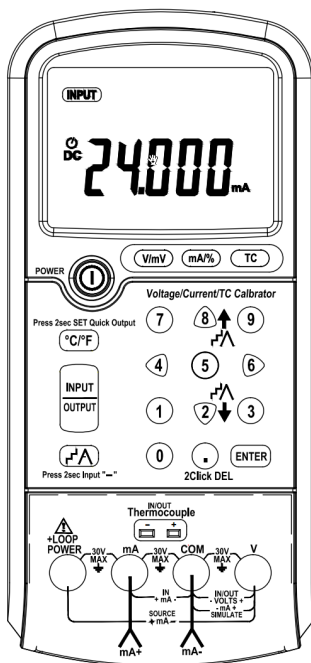


Figure 3-3-1: DC mA Current Measurement of Circuits
Powered by an External Power Supply

3.3.2 Current Measurement of Circuits Powered by the Calibrator Loop Power Supply

- ① Press the power button **5** to turn on the calibrator.
- ② Press the input / output toggle switch **10** until the display shows the input mode indicator **17**. This will set the instrument to measurement (input) mode.
- ③ Press the mA / mA% toggle switch **7** to select either mA or mA% display **28**. If mA% is selected, the “4-20mA” symbol will be displayed in the secondary display area **35**.
- ④ Connect the red test lead to the LOOP power terminal **1**, and the black test lead to the mA terminal **2**.
- ⑤ Connect the test leads/probes to the circuit or equipment to be measured.
- ⑥ Read the displayed current value **30**.

3.4 DC mA Output

3.4.1 Sourcing mA Current

- ① Press the power button **5** to turn on the calibrator.
- ② Press the input / output toggle switch **10** until the display shows the output mode indicator **18**. This will set the instrument to output mode.
- ③ Press the mA / mA% toggle switch **7** to select either mA or mA% display **28**. If mA% is selected, the “4-20mA” symbol will be displayed in the secondary display area **35**.
- ④ Press the numeric keys to set the output voltage to the desired value, then press the Enter key **13**. If you entered an incorrect value, briefly-press the Decimal point key **12** twice to clear your input.
- ⑤ Connect the red test lead to the LOOP power terminal **1**, and the black test lead to the V terminal **4**.
- ⑥ Connect the test leads/probes to the circuit or equipment to be tested.
- ⑦ If you want to change the output value, press the numeric keys. If the entered value is out of range it will revert back to the last output value. If you want to select a different mode, press the mA / mA% toggle switch **7**.

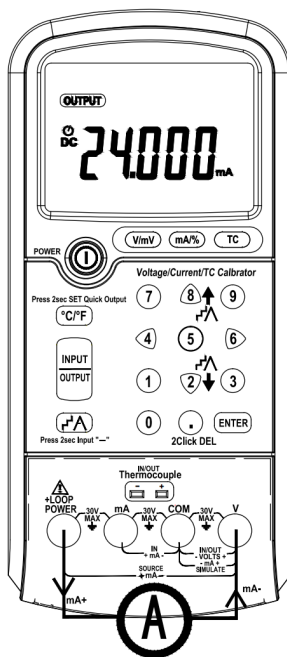


Figure 3-4-1: Sourcing mA Current

3.4.2 Simulating a Transmitter

- ① Press the power button **5** to turn on the calibrator.
- ② Press the input / output toggle switch **10** until the display shows the output mode indicator **18**. This will set the instrument to output mode.
- ③ Press the mA / mA% toggle switch **7** to select either mA or mA% display **28**. If mA% is selected, the “4-20mA” symbol will be displayed in the secondary display area **35**.
- ④ Press the numeric keys to set the output voltage to the desired value, then press the Enter key **13**. If you entered an incorrect value, briefly-press the Decimal point key **12** twice to clear your input.
- ⑤ Connect the red test lead to the V terminal **4**, and the black test lead to the COM terminal **3**.
- ⑥ Connect the test leads/probes to the circuit or equipment to be tested.
- ⑦ If you want to change the output value, press the numeric keys. If the entered value is out of range it will revert back to the last output value. If you want to select a different mode, press the mA / mA% toggle switch **7**.

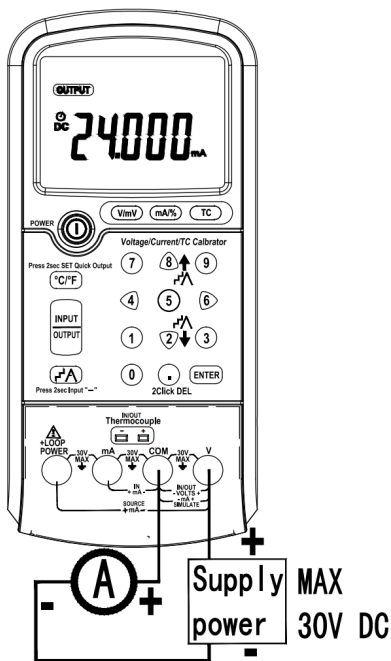


Figure 3-4-2: Simulating a Transmitter

3.5 Thermocouple Measurement

- ① Press the power button **5** to turn on the calibrator.
- ② Press the input / output toggle switch **10** until the display shows the input mode indicator **17**. This will set the instrument to measurement (input) mode.
- ③ Press the Thermocouple type selector key **8**. Then press the Temperature unit selector key **9** to display either °C or °F **29**. The ambient temperature will be displayed in the secondary display area **35**.
- ④ Press the Thermocouple type selector key **8** several times to select the type of your thermocouple.
- ⑤ Plug your thermocouple to be tested into the Thermocouple mini jack **16**. Make sure the polarity is correct!
- ⑥ Read the displayed temperature value **30**.

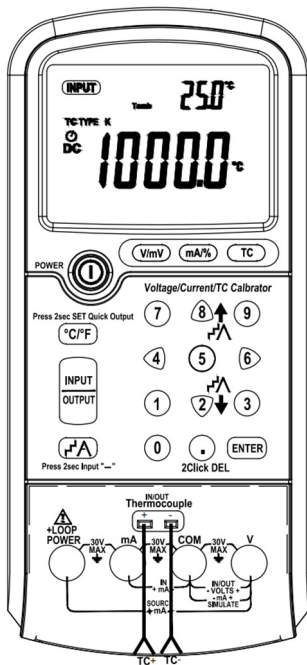


Figure 3-5: Thermocouple Measurement

3.6 Temperature Output

- ① Press the power button **5** to turn on the calibrator.
- ② Press the input / output toggle switch **10** until the display shows the output mode indicator **18**. This will set the instrument to output mode.
- ③ Press the Thermocouple type selector key **8**. Then press the Temperature unit selector key **9** to display either °C or °F **29**. The ambient temperature will be displayed in the secondary display area **35**.
- ④ Press the Thermocouple type selector key **8** several times to select the type of thermocouple you want to simulate.
- ⑤ Press the numeric keys to enter the desired temperature value, then press the Enter key **13**. If you entered an incorrect value, briefly-press the Decimal point key **12** twice to clear your input. If you want to enter a negative value, enter the value first using the numeric keys, then long-press the Minus input key **11**, and finally press the Enter key **13**. If you long-press the Minus input key **11** again, the value will turn positive (based on °C, e.g. -100°C will turn into 100°C, but -148°F will turn into 212°F). If the entered value is out of range, the output will be set to the highest or lowest value still within range for the selected thermocouple type.
- ⑥ Connect the red test lead to the V terminal **4**, and the black test lead to the COM terminal **3**.
- ⑦ Connect the test leads/probes to the circuit or equipment to be tested.

3.7 External Cold Junction / Ambient Temperature Reference

- ① Turn off the calibrator.
- ② Press and hold the Thermocouple type selector key **8**, then turn on the calibrator by pressing the power button **5**.
- ③ Use the Increment and Decrement Value buttons **14** and **15** to adjust the reference temperature value.
- ④ To store the new value and exit this mode, press the Thermocouple type selector key **8**.
- ⑤ To exit this function without changing the reference temperature, remove the batteries and re-insert them, then turn the calibrator back on.



Figure 3-7: Changing the Reference Temperature

3.8 Ladder Output

Example: Set calibrator to DC mV output, set initial output voltage to 25mV, then increase or decrease value by 25mV each step (increment/decrement button press).

- ① Press the power button **5** to turn on the calibrator.
- ② Press the input / output toggle switch **10** until the display shows the output mode indicator **18**. This will set the instrument to output mode.
- ③ Press the V/ mV toggle switch **6** to select the desired output range (in this example millivolt), indicated by the V/mV indicator **31**.
- ④ Press the numeric keys to enter the initial output voltage (in this example 25), then press the Enter key **13**.
- ⑤ Press the Ladder / Ramp output key **11**, the LCD will display the “Ladder” symbol, then use the numeric keys to enter the step value (in this example 25). Press the Enter key **13** to confirm.
- ⑥ Press the Increment key **14** to increase the output voltage by the step value and press the Decrement key **15** to decrease it (in this example, pressing the Increment key **14** changes the output voltage from 25mV to 50mV, and pressing the Decrement key **15** changes it from 25mV to 0V).
- ⑦ Press the Ladder / Ramp output key **11** again to exit this mode.

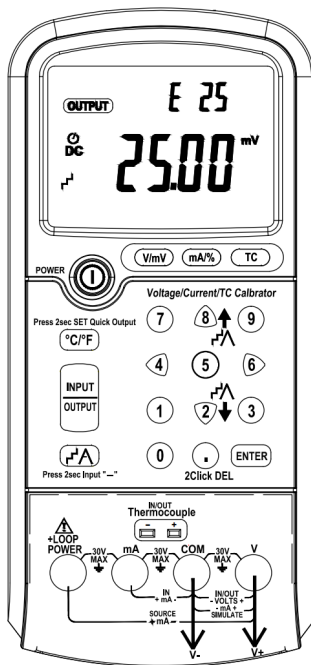


Figure 3-8: Ladder Output

3.9 Ramp Output

Example: Set calibrator to DC mV output, start at 20mV, stop at 80mV, ramp from 20mV to 80mV in 10 seconds.

- ① Press the power button **5** to turn on the calibrator.
- ② Press the input / output toggle switch **10** until the display shows the output mode indicator **18**. This will set the instrument to output mode.
- ③ Press the V/ mV toggle switch **6** to select the desired output range (in this example millivolt).
- ④ Short-Press the Ladder / Ramp output key **11** twice, the LCD will display the “Ramp” symbol. Use the numeric keys to enter the start value (in this example 20mV). Press the Enter key **13** to confirm. Next, enter the stop value (in this example 80mV), and again press Enter **13** to confirm. Finally, enter the time interval in seconds (in this example 10) and press Enter **13** to confirm.
- ⑤ The output voltage will now ramp from the start value to the stop value within the selected time interval (in this example it will go from 20mV to 80mV within 10 seconds).
- ⑥ Pressing the Increment key **14** will repeat the ramp from start to stop value. Pressing the Decrement key **15** will cause it to ramp back down again from stop to start value.
- ⑥ Press the Ladder / Ramp output key **11** again to exit this mode.

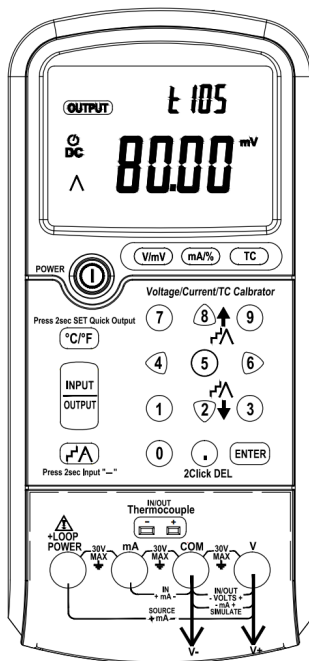


Figure 3-9: Ramp Output

3.10 Quick Output Setting

You can assign a shortcut to each of the ten keypad buttons (0..9) so that a long-press on any of these buttons sets the output of the calibrator to a value and mode of your choice.

Example: Program keypad button “8” for a “quick output” of 10V

- ① Press the power button **5** to turn on the calibrator.
- ② Press the input / output toggle switch **10** until the display shows the output mode indicator **18**. This will set the instrument to output mode.
- ③ Use the function keys **6**, **7**, or **8** to select the desired mode (V/mV, mA/mA%, or temperature). In this example, press the V/mV key **6** and select Volts.
- ④ Use the numeric keys to enter the output value to be used for quick output (in this example 10V), and press the Enter key **13** to confirm.
- ⑤ Press and hold the Temperature unit selector key **9** for 2 seconds, then press the numeric key you want to assign this output mode and value to (in this example the “8” key). The LCD will show “SETx” where x is the numeric key we assigned the quick output to (in this example SET8). Press the Enter key **13** to confirm.
- ⑥ From now on, long-pressing the “8” key will set the calibrator to output mode with an output voltage of 10V.

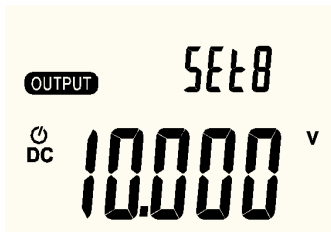



Figure 3-10: Quick Output Setting






3.11 General Functions and Features

3.11.1 Auto Power Off

The auto power off default setting is 30 minutes. If the calibrator has not been used for 30 minutes, it will turn itself off automatically.

To disable auto power off, or to change the default auto power off time of 30 minutes to a different value, follow the instructions below:

- ① Turn off the calibrator.
- ② Press and hold the mA/mA% toggle switch  then turn on the instrument by pressing the power button.

- ③ Release the mA/mA% toggle switch .
- ④ Use the Increment and Decrement Value buttons  and  to adjust the auto power off time to a value in the range of 15 minutes and 60 minutes, or disable it entirely by pressing the Decrement Value button  until the display shows “off”.
- ⑤ To store the new setting and exit this mode, press the mA/mA% toggle switch  again.

Notes: After changing the batteries, the auto power off time reverts back to the default setting of 30 minutes.

If after changing the batteries the calibrator will not turn on, remove the batteries, wait 3 minutes, reinsert the batteries and try again.

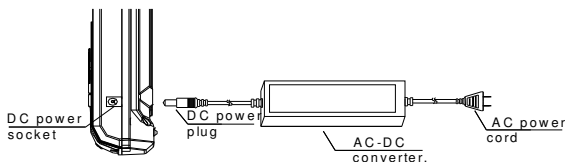
3.11.2 Using an External Power Adapter

The eC370T calibrator can be powered by an external power adapter (not included, but offered as an optional accessory). To use the calibrator with an external power adapter, please follow the instructions below:

Connecting the power adapter:


1. Connect the AC power cord to the AC/DC converter.
2. Plug the AC power cord into an electrical outlet (100V-240V AC).

3. Plug the DC power plug of the converter into the DC power socket of the calibrator (located on the right side near the bottom):



AC/DC Power Adapter Specifications:

Input: 100V-240V AC, 50-60Hz, 1.8A

Output: DC 12V , 2A MAX

Polarity: 

WARNINGS:

- 1) Please use the original AC power adapter for the eC370T. Using other AC power adapters may damage your instrument.
- 2) Do not use the AC power adapter outdoors.
- 3) Please plug the AC power cord into an electrical outlet first and then firmly insert the DC power plug into the DC power socket of the calibrator. When unplugging the AC power adapter, disconnect the DC power plug from the calibrator first, then unplug the AC power plug from the outlet.

- 4) Do not use the AC power adapter for any other equipment except for this instrument.
- 5) It is normal for the AC power adapter to get warm while in use and generate some noise.
- 6) Do not take the AC power adapter apart, as this may lead to personal injury or damage to the equipment.
- 7) Do not use the AC power adapter in a high temperature or high humidity environment.
- 8) Protect the AC power adapter from mechanical shocks or strong vibrations.

3.11.3 Using the Software via USB cable

This calibrator can be controlled via software running on a Windows PC or laptop and communicating with the calibrator through a USB link. The latest version of this software and detailed instructions on how to install and use it can be found at <https://ennoLogic.com/eC370T>.

4. TECHNICAL SPECIFICATIONS

4.1 General Specifications

- Maximum voltage between any terminal and earth ground or between any two terminals: 30V
- Storage temperature: -40°C to 60°C (-40°F to 140°F)
- Operating temperature: -10°C to 50°C (14°F to 122°F)
- Maximum operating altitude: 2000m (6562ft)
- Temperature coefficient: $\pm 0.01\%$ of range per °C for the temperature range of -10°C to 55°C (14°F to 131°F)
- Relative humidity: 95% up to 30°C (86°F), 75% up to 40°C (104°F), 45% up to 50°C (122°F), 35% up to 50°C (122°F)
- Shock: Random 2g, 5Hz to 500Hz
- Safety: 1 meter drop test
- Power: 6x AAA batteries
- Size: 204mm x 99mm x 46mm (8" x 3.9" x 1.8")
- Weight: 465g (1 lbs.) including batteries

4.2 Measurement Specifications

4.2.1 DC V Input and Output

Range	Resolution	Accuracy (\pm (% of reading + Counts))
100 mV	0.01 mV	0.06 % + 4
20 V	0.001 V	0.08 % + 5
Input impedance: 2M Ω (nominal), < 100pF Over voltage protection: 30V Maximum load current: 1mA		

4.2.2 DC mA Input and Output

Range	Resolution	Accuracy (\pm (% of reading + Counts))
24 mA	0.001mA	0.08% + 5
Overload protection: 125 mA 250V fast acting fuse Percent display: 0%=4mA, 100%=20mA Source mode: Can drive up to 20mA @ 1000 Ω if the battery voltage is >6.8V. The maximum load resistance is reduced to 700 Ω if the battery voltage is 5.8..6.8V. Simulator mode: External loop voltage: 24V nominal, 30V maximum, 12V minimum.		

4.2.3 Measurement and Output of Temperatures

Thermocouple	Range	Resolution
K (CA)	-200.0°C ~ +1370.0°C	± 0.7 °C
J (IC)	-200.0°C ~ +1200.0°C	± 0.7 °C
E (CRC)	-200.0°C ~ +1000.0°C	± 0.7 °C
T (CC)	-200.0°C ~ +400.0°C	± 0.7 °C
N	-250.0°C ~ +1300.0°C	± 0.7 °C
S (PR10)	-20°C ~ +1750°C	± 2 °C
R (PR13)	-20°C ~ +1750°C	± 2 °C
B (PR30)	+600°C ~ +1800°C	± 2 °C

Add 0.3°C to the stated error if CJC is used.

4.2.4 LOOP POWER

24V ± 10%

5. MAINTENANCE

This section provides basic maintenance information, including fuse and battery replacement instructions. Do not attempt to repair or service your calibrator unless you are qualified to do so and have the relevant calibration, performance test, and service information.


5.1 General Maintenance



To avoid electrical shock or damage to the instrument, do not get water inside the enclosure. Remove the test leads and any input signals before opening the enclosure.

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents. Dirt or moisture in the terminals can affect readings.

5.2 Battery Replacement

Please change the battery when the LCD indicates . Turn off the calibrator and unplug an external power adapter. Use a screwdriver to unscrew the two screws on the battery cover on the back of the unit near the bottom, behind the stand. Remove the battery cover from the meter. If you are replacing the batteries: remove the used AAA batteries. Install six new AAA batteries. Pay attention to

polarity when you insert each battery, the polarity is indicated inside the battery compartment. Replace the battery cover and tighten the screws. Do not use the calibrator until the battery cover has been properly installed.

5.2 Fuse Replacement



Before replacing the fuse, disconnect test leads and/or any connectors from any circuit under test. To prevent damage or injury replace the fuse only with a 0.125A 250V fast fuse.

If the LCD displays the “Output unstable” indicator 34 (see Figure 2-2) in voltage output mode with the test leads unplugged, Fuse 1 is most likely blown.

If the calibrator always reads 0.000 in mA input mode even when a signal is applied, Fuse 2 is most likely blown.

6. Accessories

Package Contents:

- | | |
|-----------------------------------|-----------------------------------|
| • Volt/mA/TC
Calibrator eC370T | • 1x Type K
Thermocouple probe |
| • 1x pair of test leads | • 6x AAA batteries |
| • 1x pair of alligator
clips | • User manual |
| • 1x Mini-USB cable | • Carrying case |

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