

	311PLUS FIELD CALIBRATION PROCEDURE	DOCUMENT NO. 311+-0300	82 East Main Street Suite 3.14 Webster, New York 14580 Phone (585) 872-9350 Fax (585) 872-2638 www.piecal.com Sheet 1 of 11
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REV	RA	DATE	RN	CHANGE	APPD
A	JW	07-26-17	---	Initial creation and release	MJK 07-27-17

Suggested Equipment:

- 1) Precision DC Voltage Meter with Accuracy of ± 0.0002 mV
- 2) Voltage source adjustable from $0.000V_{DC}$ to $60.000V_{DC}$
- 3) Precision Ohm Meter with Accuracy of $\pm 0.0125\Omega$
- 4) Precision $100\ \Omega$ Resistor with accuracy and stability of $\pm 0.003\%$ between 18°C and 28°C

Abbreviations:

PIE = Practical Instrument Electronics

UUT = Unit Under Test = PIE Model 311PLUS

Disassembly:

Begin by removing the Boot, EZ-Dial™ Knob and the nut under the knob. Next turn the unit over and remove the battery cover, the batteries and the four black Phillips head corner screws. While holding the PIE UUT in one hand, carefully remove the top of the housing. Place the EZ-DIAL knob back on to make adjusting the calibrator easier. Place fresh AA batteries in and allow 15 minutes for the UUT to stabilize to the ambient temperature.

Enabling Calibration:

On the back side of the PCB is a pair of small switches (Dual in Line Package or DIP Switches). If DIP switches are covered by seal, remove or break seal to expose switches. Move DIP switch 2 (the switch on the right) up (ON). Move the UUT power switch to SOURCE. The word “CALIBRATION” will appear on instead of the normal splash screen. Verify it is in calibration mode by making sure the word “CAL” is in the upper left corner of the display.

As you calibrate the UUT please be patient and wait a few seconds after you press the knob to store values before double clicking the knob to go to the next step.

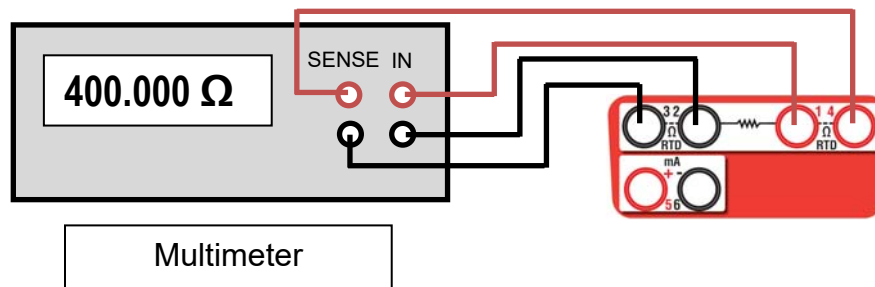
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This is the SOURCE section of the calibration procedure

Source Ohms

Source 400 Ohms Range (400 Ω):

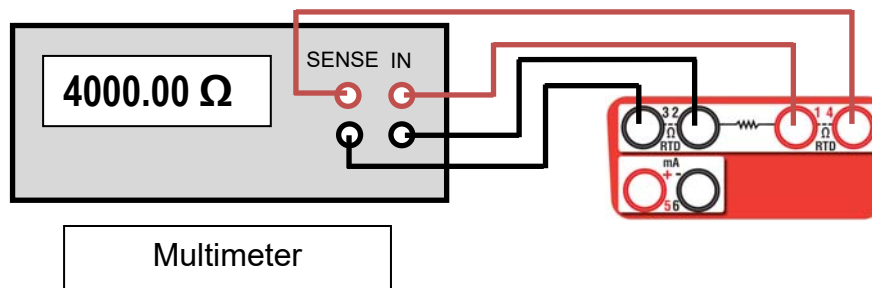
- 1) Connect 4 leads from the UUT to the meter using 4 wire hookup and set meter to 1ma excitation current (#.#### K Ω).
- 2) Move EZ-CHECK switch to LO. SOURCE 0.00 Ω should appear on the UUT display.
- 3) Dial the UUT output until the meter reads as close to 0.000 Ω as possible. NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 4) Press the knob until the display shows STORE.
- 5) Move EZ-CHECK switch to HI. SOURCE 400.00 Ω should appear on the UUT display.
- 6) Dial the UUT output until the meter reads as close to 400.000 Ω as possible. NOTE: This value may be above or below the target value. Always select value closest to the target value..
- 7) Press the knob until the display shows STORE.
- 8) Double click the knob to change to the next function to be calibrated.



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Source 4000 Ohms Range (4K Ω):

- 1) Connect 4 leads from the UUT to the meter using 4 wire hookup and set meter to 100 μ A excitation current (#.#### K Ω).
- 2) Move EZ-CHECK switch to LO. SOURCE 0.00 Ω should appear on the UUT display.
- 3) Dial the UUT output until the meter reads as close to 0.00 Ω as possible. NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 4) Press the knob until the display shows STORE.
- 5) Move EZ-CHECK switch to HI. SOURCE 4000.0 Ω should appear on the UUT display.
- 6) Dial the UUT output until the meter reads as close to 4000.00 Ω as possible. NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 7) Press the knob until the display shows STORE.
- 8) Double click the knob to move to the next function to be calibrated.

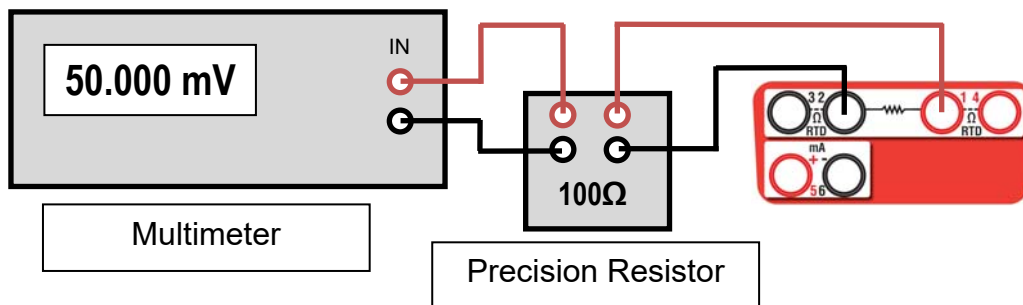


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Source mA

Read Ohms Excitation Current (mA Ω):

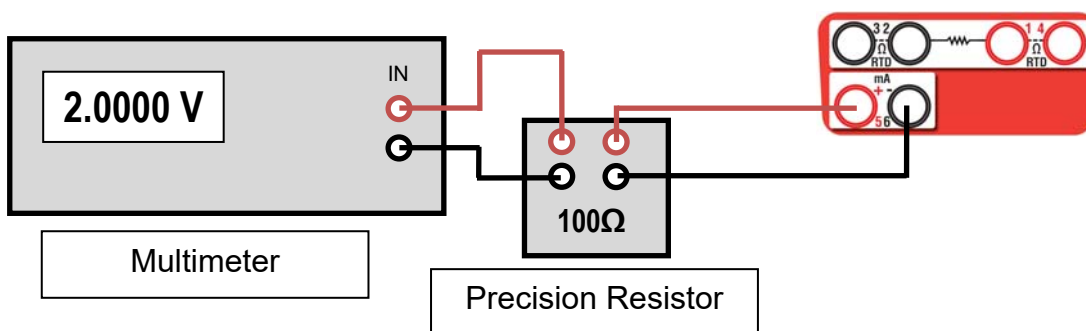
- 1) Connect leads from the UUT mV terminals (1 & 2) to a precision 100 Ω resistor. Connect another set of leads from the resistor to the meter and set meter to mV range (##.### mV)
- 2) Move EZ-CHECK switch to LO. SOURCE 0.005 mA should appear on the UUT display.
- 3) Dial the UUT output until the meter reads as close to 0.500 mV as possible.
NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 4) Press the knob until the display shows STORE.
- 5) Move EZ-CHECK switch to HI. SOURCE 0.500 mA should appear on the UUT display.
- 6) Dial the UUT output until the meter reads as close to 50.000 mV as possible.
NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 7) Press the knob until the display shows STORE.
- 8) Double click the knob to move to the next function to be calibrated.



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Source 20 mA Range (mA):

- 1) Connect leads from the UUT mA terminals (5 & 6) to a precision 100 Ω resistor. Connect another set of leads from the resistor to the meter and set meter to mV range (##### mV)
- 2) Move EZ-CHECK switch to LO. SOURCE 0.010 mA should appear on the UUT display.
- 3) Dial the UUT output until the meter reads as close to 1.000 mV as possible.
NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 4) Press the knob until the display shows STORE.
- 5) Move EZ-CHECK switch to SET. SOURCE 4.000 mA should appear on the UUT display.
- 6) Dial the UUT output until the meter as close to 0.4000 V as possible.
NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 7) Press the knob until the display shows STORE.
- 8) Move EZ-CHECK switch to HI. SOURCE 20.000 mA should appear on the UUT display.
- 9) Dial the UUT output until the meter as close to 2.0000 V as possible. NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 10) Press the knob until the display shows STORE.



*This concludes the SOURCE section of the calibration.
The next steps are to calibrate the READ circuitry.*

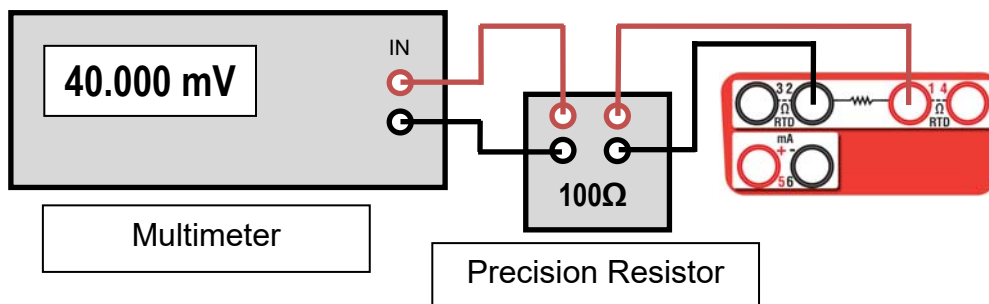
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This is the READ section of the calibration procedure

Read Ohms

Read Ohms Excitation Current Verification (mA Ω): (No Adjustments Required)

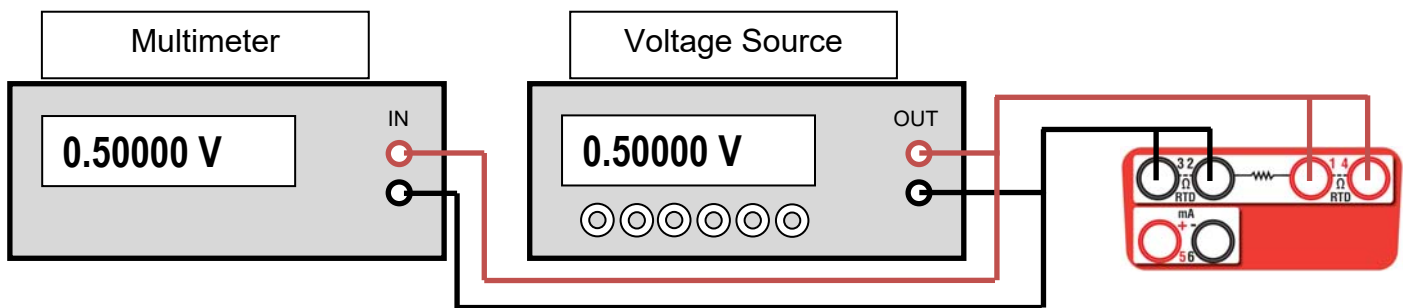
- 1) Switch the power switch to OFF, wait 5 seconds then move the power switch to READ.
- 2) Connect leads from the UUT mV terminals (1 & 2) to a precision 100 Ω resistor. Connect another set of leads from the resistor to the precision V meter and set meter to mV range (##.### mV).
- 3) Move EZ-CHECK switch to LO. VERIFY 3 μ A should appear.
- 4) Verify that the meter (0.300 mV) matches the display (3.00) to ± 0.012 mV (± 12 counts). If not, repeat Source Ohms Excitation Currents from the Source Ohms section of the calibration procedure.
- 5) Move EZ-CHECK switch to SET. VERIFY 400 μ A should appear.
- 6) Verify that the meter (40.00 mV) matches the display (400.00) to ± 0.012 mV (± 12 counts). If not, repeat Source Ohms Excitation Currents from the Source Ohms section of the calibration procedure.
- 7) Move EZ-CHECK switch to HI. VERIFY 900 μ A should appear.
- 8) Verify that the meter (90.00 mV) matches the display (900.00) to ± 0.012 mV (± 12 counts). If not, repeat Source Ohms Excitation Currents from the Source Ohms section of the calibration procedure.
- 9) Double click the knob to move to the next function to be calibrated.



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Read Ohms 2 & 4 Wire Calibration (2WV 4WV Ω):

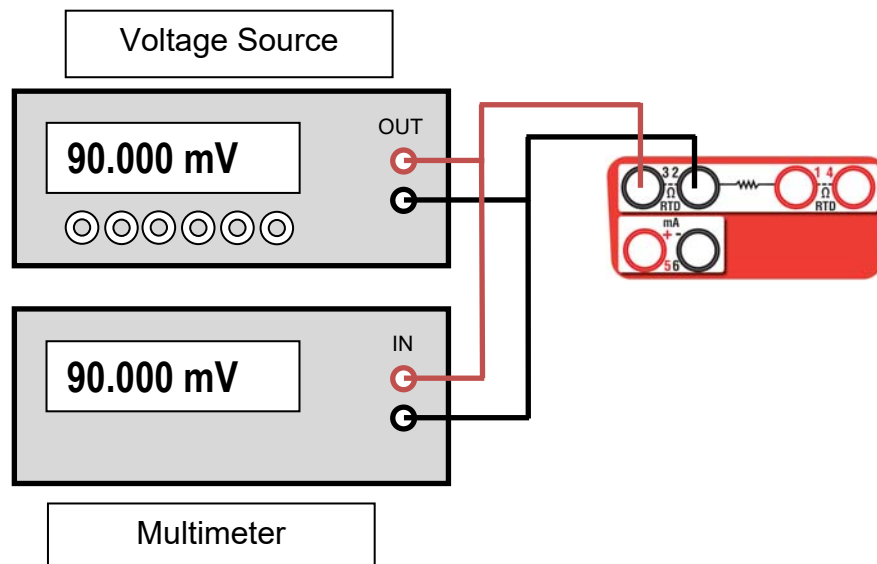
- 1) Put a four terminal shorting bar across UUT terminals 1, 2, 3 & 4.
- 2) Move EZ-CHECK switch to LO. APPLY 0.000 V should appear on the UUT display.
- 3) Press the knob until the display shows STORE.
- 4) Move EZ-CHECK switch to SET. APPLY 500 mV should appear on the UUT display.
- 5) Connect a precision voltage source + to terminals 1 & 4 and – to 2 & 3 on the UUT.
Connect another set of leads to a precision DC voltage meter.
- 6) Dial the voltage source as close to 0.50000 V as possible. NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 7) Press the knob until the display shows STORE.
- 8) Move EZ-CHECK switch to HI. APPLY 2.0 V should appear on the UUT display.
- 9) Dial the voltage source to as close 2.0000 V as possible. NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 10) Press the knob until the display shows STORE.
- 11) Double click the knob to move to the next function to be calibrated.



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Read Ohms 3 Wire Calibration (3WV Ω):

- 1) Put a two terminal shorting bar across UUT terminals 2 & 3.
- 2) Move EZ-CHECK switch to LO. APPLY 0.000 mV should appear on the UUT display.
- 3) Press the knob until the display shows STORE.
- 4) Move EZ-CHECK switch to HI. APPLY 90.000 mV should appear on the UUT display.
- 5) Connect a precision voltage source + to terminal 3 and – to 2. Connect another set of leads to a precision DC voltage meter.
- 6) Dial the voltage source to as close to 90.0000 mV as possible. NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 7) Press the knob until the display shows STORE.
- 8) Double click the knob to move to the next function to be calibrated.



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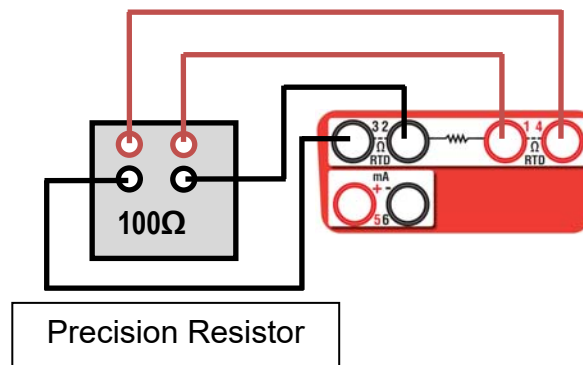
Note: The Ohms verification test requires that all four leads are of equal low ($< .1 \text{ ohm}$) resistance (equal length with identical connectors on each end).

Read 400 Ohms Verification (400 Ω):

- 1) Connect a precision 100 Ohm resistor to all four Ω terminals.
- 2) Move EZ-CHECK switch to LO (2 W). Verify display is $100.00 \Omega \pm 0.06 \Omega$
- 3) Move EZ-CHECK switch to SET (3 W). Verify display reads $100.00 \Omega \pm 0.06 \Omega$.
- 4) Move EZ-CHECK switch to HI (4 W). Verify display reads $100.00 \Omega \pm 0.06 \Omega$.
- 5) Double click the knob to move to the next function to be calibrated.

Read 4000 Ohms Verification (4000 Ω):

- 1) Keep precision 100 Ω resistor connected to all four Ω terminals.
- 2) Move EZ-CHECK switch to LO (2 W). Verify display is $100.0 \Omega \pm 0.6 \Omega$.
- 3) Move EZ-CHECK switch to SET (3 W). Verify display reads $100.0 \Omega \pm 0.6 \Omega$.
- 4) Move EZ-CHECK switch to HI (4 W). Verify display reads $100.0 \Omega \pm 0.6 \Omega$.
- 5) Double click the knob to move to the next function to be calibrated.

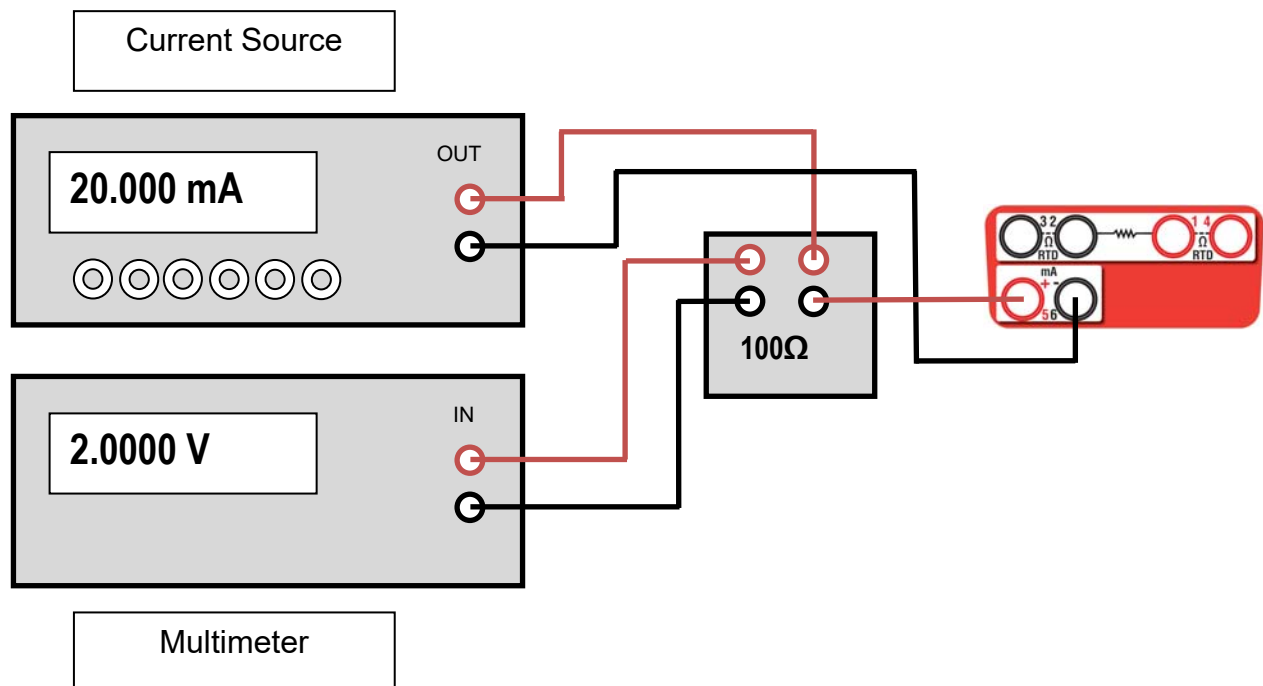


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Read mA

Read mA Range:

- 1) Leave all connections open.
- 2) Move EZ-CHECK switch to LO. Apply 0.000 mA should appear on the UUT display.
- 3) Press the knob until the display shows STORE.
- 4) Move EZ-CHECK switch to HI. APPLY 20.000 mA should appear on the UUT display.
- 5) Connect leads from the mA terminals (5 & 6) in series with a current source and a precision 100 Ω resistor. Connect another set of leads from the resistor to the precision V meter and set meter to V range (##### V).
- 6) Dial the current source as close to 20.000 mA as possible. The meter will read 2.0000 V
NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 7) Press the knob until the display shows STORE.
- 8) Double click the knob to move to the next function to be calibrated.

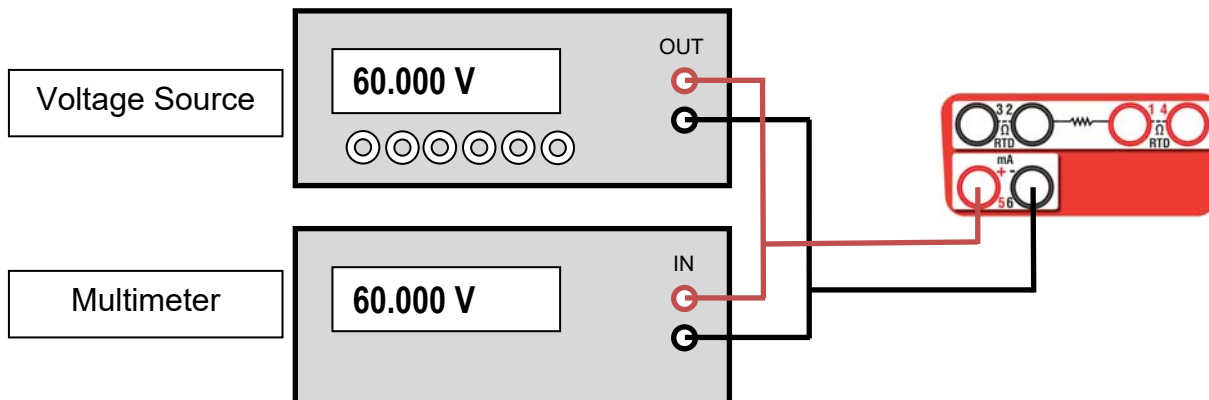


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Read V

Read 60V Range:

- 1) Put a two terminal shorting bar across Read V terminals (5 & 6).
- 2) Move EZ-CHECK switch to LO. APPLY 0.000 V should appear on the UUT display.
- 3) Press the knob until the display shows STORE.
- 4) Move EZ-CHECK switch to SET. APPLY 10.000 V should appear on the UUT display.
- 5) Connect a precision voltage source to Read V terminals (5 & 6). Connect another set of leads to a precision V meter.
- 6) Dial the voltage source as close to 10.000 V as possible. NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 7) Press the knob until the display shows STORE.
- 8) Move EZ-CHECK switch to HI. APPLY 60.000 V should appear on the UUT display.
- 9) Connect a precision voltage source to Read V terminals (5 & 6). Connect another set of leads to a precision V meter.
- 10) Dial the voltage source as close to 60.000 V as possible. NOTE: This value may be above or below the target value. Always select value closest to the target value.
- 11) Press the knob until the display shows STORE.



Completion of Calibration

Turn the UUT OFF and Move DIP switch 2 (the switch on the right) down toward the batteries (OFF). Place a seal sticker over the DIP switches. The next time the unit is turned on the UUT will be calibrated and in normal operational mode. Reassemble unit in reverse order from Disassembly.