

 PIE Practical Instrument Electronics	PIE Model 211&311 FIELD TEST PROCEDURE	DOCUMENT NO. 211-0300 REV B	82 Main Street Suite 3.14 Webster New York 14580 Phone (585) 872-9350 Fax (585) 872-2638
Created by: Paul B-G	DATE: 2-4-2010	Sheet 1 of 12	

Rev.	Date	Appd	CHANGE	Approved
A	3-31-10	PBG	INITIAL RELEASE	
B	11-25-15	BH	Updated hardware and software for DNC 88	

Note: There are two versions of the PIECAL 211 and 311

If firmware shown at turn on is 2.## or below follow the procedure that begins on page 2.
For firmware 3.## and above follow procedure on page 5.

	PIE Model 211&311 FIELD TEST PROCEDURE	DOCUMENT NO. 211-0300 REV B	82 Main Street Suite 3.14 Webster New York 14580 Phone (585) 872-9350 Fax (585) 872-2638
Created by: Paul B-G	DATE: 2-4-2010	Sheet 2 of 12	

Equipment Needed:

1. Precision OHM Meter with accuracy of 0.004% at 4000Ω.
2. Precision OHM Source with accuracy of 0.004% at 4000Ω.

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 PIECAL 211 or 311 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 batteries in and allow 15 minutes for the Model 211 or 311 to stabilize to the ambient temperature.

Calibration for firmware 2.## and below.

Enabling Calibration:

Make sure you are working at a grounded station and are wearing a ground strap. If you do not have a ground strap, make sure you touch a ground immediately before handling the calibrator. This is especially important when enabling the calibration! Place the PIECAL 211 or 311 into calibration mode by shorting the vias (calibration points labeled J11) located on the right side of the PCB next to the power switch and turn the UUT on to SOURCE. Verify the PIECAL 211 or 311 are in calibration mode indicated by the word "CAL RTD" on the LCD. Remove the calibration short before proceeding.

	PIE Model 211&311 FIELD TEST PROCEDURE	DOCUMENT NO. 211-0300 REV B	82 Main Street Suite 3.14 Webster New York 14580 Phone (585) 872-9350 Fax (585) 872-2638
Created by: Paul B-G	DATE: 2-4-2010	Sheet 3 of 12	

Source Ω Calibration:

Connect the PIECAL 211 or 311 to an OHM Meter in four-wire configuration (See Figure 1).

LO Calibration:

1. Slide the EZ-Check™ Switch down to the LO position.
2. Dial the PIECAL 211 or 311 so the meter reads 0.000 Ω .
3. Press and hold down the EZ-Dial™ Knob.
4. The display will flash “STORED” to confirm that the value was stored. Release the knob.

HI Calibration:

1. Slide the EZ-Check™ Switch to the DIAL position indicated by displaying “DIAL TO MATCH DMM” on the bottom of the LCD .
2. Dial the PIECAL 211 or 311 so the UUT matches the reading on the DMM.
3. Press the EZ-Dial™ Knob down.
4. The display will flash “STORED” to confirm that the value was stored.

Middle Calibration:

5. Slide the EZ-Check™ Switch to the HI position indicated by displaying “DIAL TO MATCH DMM” on the bottom of the LCD.
6. Dial the PIECAL 211 or 311 so the UUT matches the reading on the DMM.
7. Press the EZ-Dial™ Knob down.
8. The display will flash “STORED” to confirm that the value was stored.

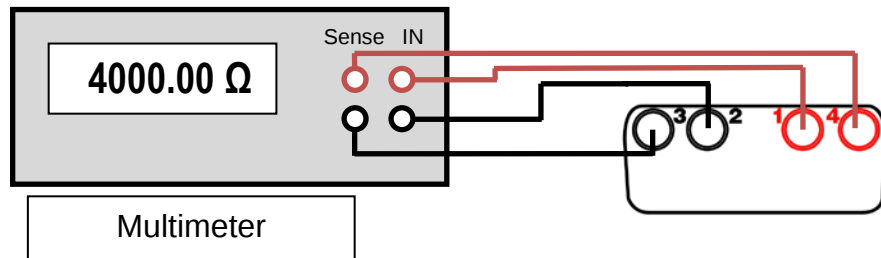


FIGURE 1 (Source OHM)

	PIE Model 211&311 FIELD TEST PROCEDURE	DOCUMENT NO. 211-0300 REV B	82 Main Street Suite 3.14 Webster New York 14580 Phone (585) 872-9350 Fax (585) 872-2638
Created by: Paul B-G	DATE: 2-4-2010	Sheet 4 of 12	

Read Ω Calibration:

Quickly move the power switch down to READ without pausing in the off position and make sure the PIECAL 211 or 311 are in calibration mode indicated by the word “CAL” on the LCD. If “CAL” is not displayed follow the steps in Enabling Calibration but move the power switch to READ.

LO Calibration:

1. Slide the EZ-Check™ switch down to the LO position indicated by displaying “APPLY APPLY 00.00 Ω ”.
2. Short all 4 input terminals of the UUT.
3. Press and hold down the EZ-Dial™ Knob.
4. The display will flash “STORED” to confirm that the value was stored. Release the knob.

HI Calibration:

1. Slide the EZ-Check™ switch up to the HI Position indicated by displaying “APPLY APPLY 4000.00 Ω ”.
2. Connect a precision 4000 Ω standard resistor or decade box to the UUT (See Figure 2).
3. Press and hold down the EZ-Dial™ Knob.
4. The display will flash “STORED” to confirm that the value was stored. Release the knob.

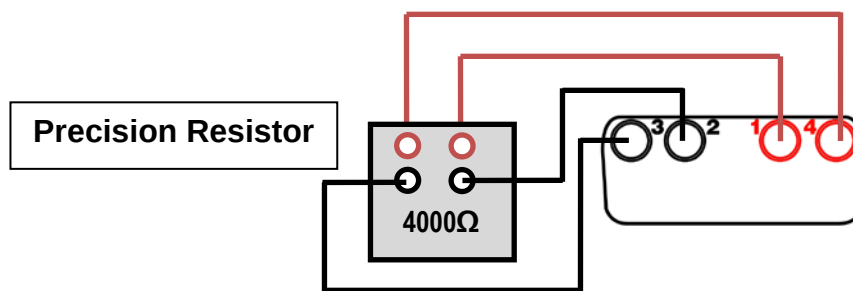


Figure 2 (Read OHM)

Completion of Calibration:

Turn the PIECAL 211 or 311 OFF before removing the batteries. Next time the unit is turned on the PIECAL 211 or 311 will be calibrated and in normal operational mode. Reassemble in reverse order from disassembly.

	PIE Model 211&311 FIELD TEST PROCEDURE	DOCUMENT NO. 211-0300 REV B	82 Main Street Suite 3.14 Webster New York 14580 Phone (585) 872-9350 Fax (585) 872-2638
Created by: Paul B-G	DATE: 2-4-2010	Sheet 5 of 12	

Calibration for firmware 3.## and above.

Equipment Needed:

- 1) Precision DC Voltage Meter with accuracy of ± 0.0032 mV @ 0 mv
- 2) Precision Ohm Meter with accuracy of
 - a. ± 0.028 Ohms @ 0.00 and 400.00 Ohms with 1mA excitation current
 - b. ± 0.23 Ohms @ 0.0 and 4000.0 Ohms with 100 μ A excitation current
- 3) Precision 100 Ω Resistor accurate to ± 0.016 Ohms
- 4) Power supply capable of ~ 12 V with adjustable current limiting capability
- 5) 2 sets of quality test leads with banana plugs.

Abbreviations:

UUC = Unit Under Calibration = PIE Model 211 or 311

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 525B 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 batteries in and allow 15 minutes for the Model 525B 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). Move DIP switch 2 (the switch on the right) up (ON). Move Unit under Calibration /PIECAL 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 PIECAL 211 or 311 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.

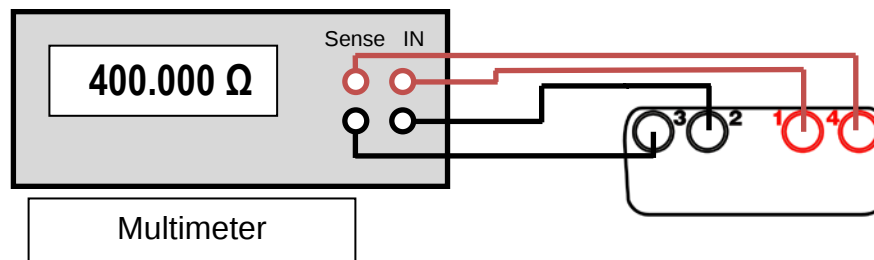
	PIE Model 211&311 FIELD TEST PROCEDURE	DOCUMENT NO. 211-0300 REV B	82 Main Street Suite 3.14 Webster New York 14580 Phone (585) 872-9350 Fax (585) 872-2638
Created by: Paul B-G	DATE: 2-4-2010	Sheet 6 of 12	

This is the SOURCE section of the calibration procedure

Source Ohms

Source 400 Ohms Range (400 Ω):

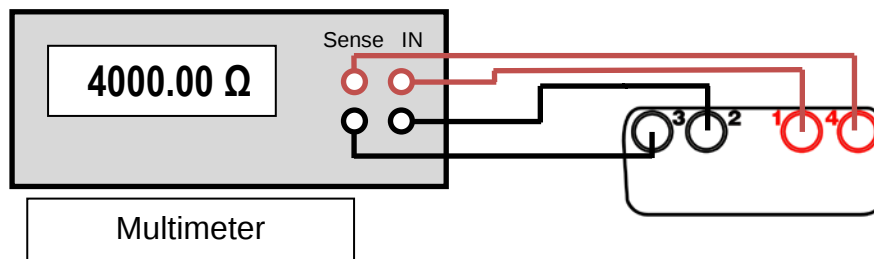
- 1) Connect using 4 wire hookup and set meter to 1mA excitation current (##### K Ω).
- 2) Move EZ-CHECK switch to LO. SOURCE 0.00 Ω should appear on the LCD.
- 3) Dial the UUC output until the meter reads as close to 0.000 Ω as possible.
NOTE: This value may be above or below the target value. Always select value closest to the target value. This should be within ± 0.006 Ω .
- 4) Press the knob until the display shows STORE.
- 5) Move EZ-CHECK switch to HI. SOURCE 400.00 Ω should appear on the LCD.
- 6) Dial the UUC 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. This should be within ± 0.006 Ω .
- 7) Press the knob until the display shows STORE.
- 8) Move the EZ-CHECK switch to SET. INVALID SETTING should appear on the LCD but the UUC will default to a 200.00 Ω output setting. Verify that the meter (#####K Ω) matches the displayed setting of the UUC. This should be within ± 0.006 Ω .
- 9) Double click the knob to move to the next function to be calibrated.



	PIE Model 211&311 FIELD TEST PROCEDURE	DOCUMENT NO. 211-0300 REV B	82 Main Street Suite 3.14 Webster New York 14580 Phone (585) 872-9350 Fax (585) 872-2638
Created by: Paul B-G	DATE: 2-4-2010	Sheet 7 of 12	

Source 4000 Ohms Range (4K Ω):

- 1) Connect 4 leads from the UUC to the meter using 4 wire hookup and set meter to 100 uA excitation current (##.#### K Ω).
- 2) Move EZ-CHECK switch to LO. SOURCE 0.00 Ω should appear on the UUC display.
- 3) Dial the UUC 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. This should be within ± 0.6 Ω .
- 4) Press the knob until the display shows STORE.
- 5) Move EZ-CHECK switch to HI. SOURCE 4000.0 Ω should appear on the UUC display.
- 6) Dial the UUC output until the meter reads as close to 4000.00 Ω as possible.
NOTE: This value may be above or below the target value. This should be ± 0.6 Ω .
- 7) Press the knob until the display shows STORE.
- 8) Move the EZ-CHECK switch to SET. INVALID SETTING should appear on the LCD but the UUC will default to a 2000.0 Ω output setting. Verify that the meter (##.####K Ω) matches the displayed setting of the UUC. This should be within ± 0.006 Ω .
- 9) Double click the knob to move to the next function to be calibrated.

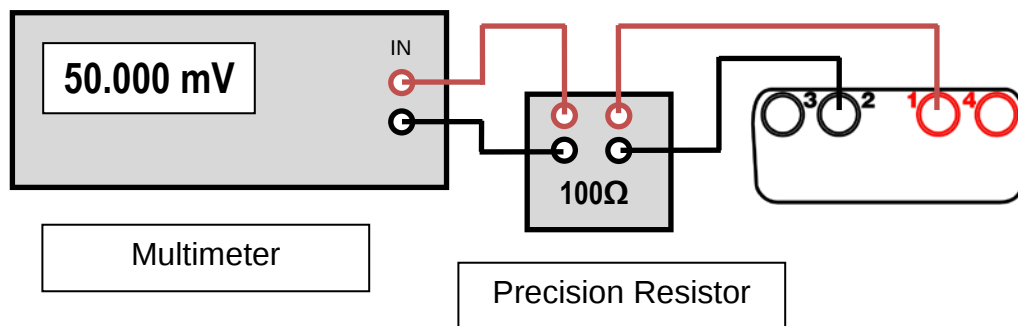


	PIE Model 211&311 FIELD TEST PROCEDURE	DOCUMENT NO. 211-0300 REV B	82 Main Street Suite 3.14 Webster New York 14580 Phone (585) 872-9350 Fax (585) 872-2638
Created by: Paul B-G	DATE: 2-4-2010	Sheet 8 of 12	

Source mA

Read Ohms Excitation Current (0.500 mA) (mA Ω):

- 1) Connect leads from the UUC 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 UUC display.
- 3) Dial the UUC 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. This should be within ± 0.006 mV
- 4) Press the knob until the display shows STORE.
- 5) Move EZ-CHECK switch to HI. SOURCE 0.500 mA should appear on the UUC display.
- 6) Dial the UUC 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. This should be within ± 0.009 mV.
- 7) Press the knob until the display shows STORE.
- 8) Move the EZ-CHECK switch to SET. INVALID SETTING should appear on the LCD but the UUC will default to a 0.4000 mA output setting. Verify that the meter (##.####mV) approximately matches the displayed setting of the UUC.
- 9) Double click the knob to move to the next function to be calibrated.



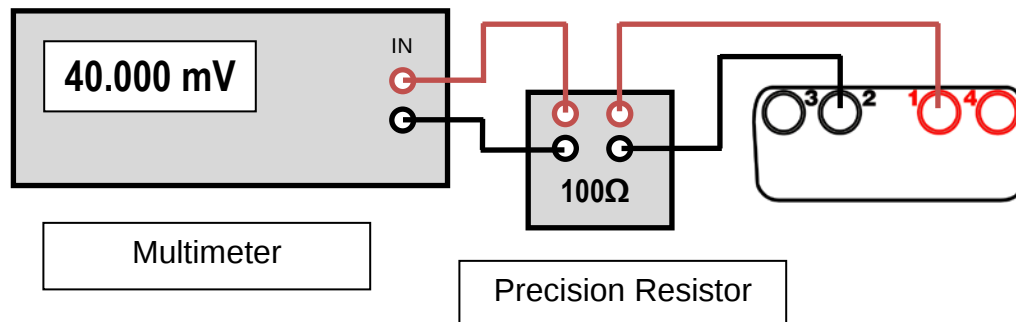
*This concludes the SOURCE section of the calibration.
The next steps are to calibrate the READ circuitry.*

	PIE Model 211&311 FIELD TEST PROCEDURE	DOCUMENT NO. 211-0300 REV B	82 Main Street Suite 3.14 Webster New York 14580 Phone (585) 872-9350 Fax (585) 872-2638
Created by: Paul B-G	DATE: 2-4-2010	Sheet 9 of 12	

Read Ohms

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

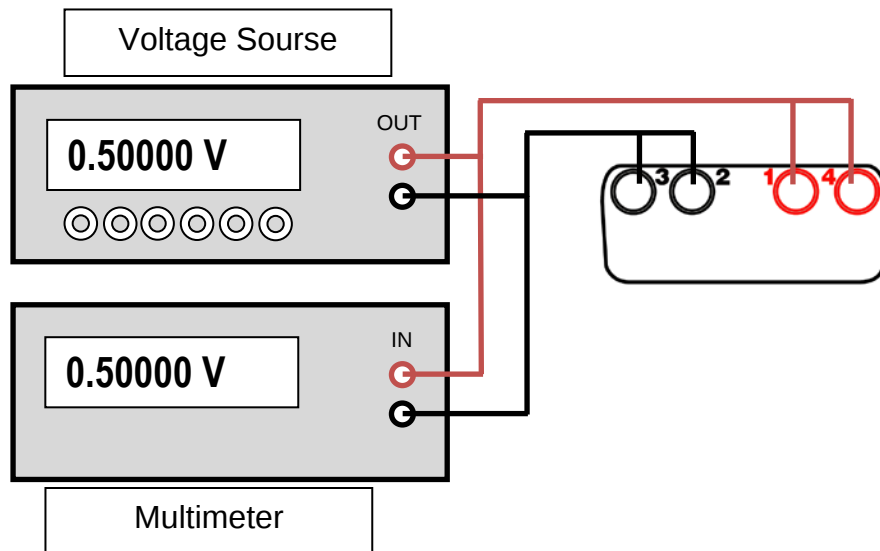
- 1) Switch the power switch to OFF, wait 5 seconds then move the power switch to READ.
- 2) Connect leads from the UUC terminals 1 & 2 to a precision 100 Ω resistor. Connect another set of leads from the resistor to the precision V meter and set meter to mV range (##.### mV).
- 3) Move EZ-CHECK switch to LO. VERIFY 3uA should appear on the UUC display. Verify that the meter (0.300 mV) matches the display within ± 0.012 mV. If not, repeat Source Ohms Excitation Currents from the Source Ohms section of the calibration procedure.
- 4) Move EZ-CHECK switch to SET. VERIFY 400uA should appear on the UUC display. Verify that the meter (40.000 mV) matches the display within ± 0.012 mV. If not, repeat Source Ohms Excitation Currents from the Source Ohms section of the calibration procedure.
- 5) Move EZ-CHECK switch to HI. VERIFY 900uA should appear on the UUC display. Verify that the meter (90.000 mV) matches the display within ± 0.012 mV. If not, repeat Source Ohms Excitation Currents from the Source Ohms section of the calibration procedure.
- 6) Double click the knob to move to the next function to be calibrated.



	PIE Model 211&311 FIELD TEST PROCEDURE	DOCUMENT NO. 211-0300 REV B	82 Main Street Suite 3.14 Webster New York 14580 Phone (585) 872-9350 Fax (585) 872-2638
Created by: Paul B-G	DATE: 2-4-2010	Sheet 10 of 12	

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

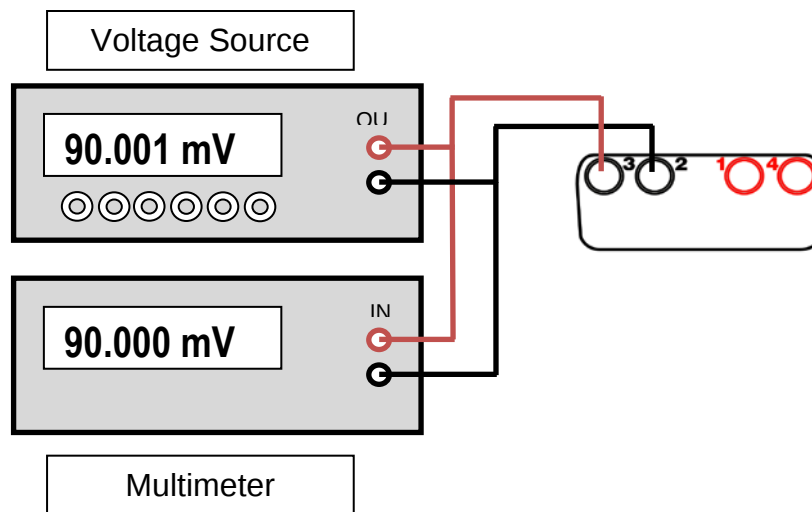
- 1) Move EZ-CHECK switch to LO. APPLY 0.000 V should appear on the UUC display.
Short all four (1, 2, 3 & 4) inputs together.
- 2) Press the knob until the display shows STORE.
- 3) Move EZ-CHECK switch to SET. APPLY 500 mV should appear on the UUC display.
- 4) Connect a precision voltage source + to terminals 1 & 4 and – to 2 & 3 on the UUC.
Connect another set of leads to a precision DC voltage meter.
- 5) 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. This should be within. ± 0.00004 V.
- 6) Press the knob until the display shows STORE.
- 7) Move EZ-CHECK switch to HI. APPLY 2.0 V should appear on the UUC display.
- 8) 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. This should be within ± 0.0013 V.
- 9) Press the knob until the display shows STORE.
- 10) Double click the knob to move to the next function to be calibrated.



	PIE Model 211&311 FIELD TEST PROCEDURE	DOCUMENT NO. 211-0300 REV B	82 Main Street Suite 3.14 Webster New York 14580 Phone (585) 872-9350 Fax (585) 872-2638
Created by: Paul B-G	DATE: 2-4-2010	Sheet 11 of 12	

Read Ohms 3 Wire Calibration (3WV Ω):

- 1) Short UUC terminals 2 & 3 together.
- 2) Move EZ-CHECK switch to LO. APPLY 0.000 mV should appear on the UUC 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 UUC 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. This should be within ± 0.0135 mV.
- 7) Press the knob until the display shows STORE.
- 8) Move EZ-CHECK switch to SET. Dial the voltage source to a value between 0.000 and 90.000 mV and verify the UUC reading matches the reading of the DC voltage meter.
- 9) Double click the knob to move to the next function to be calibrated.

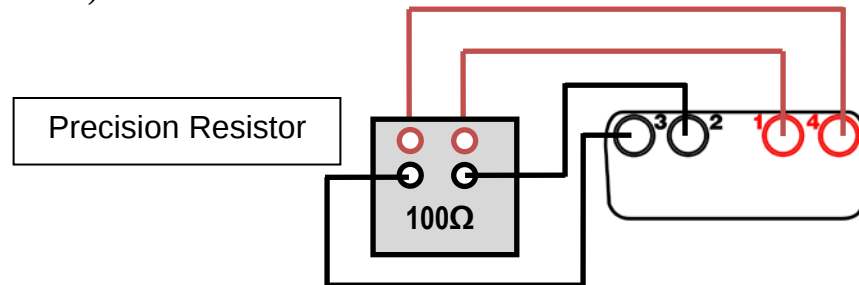


	PIE Model 211&311 FIELD TEST PROCEDURE	DOCUMENT NO. 211-0300 REV B	82 Main Street Suite 3.14 Webster New York 14580 Phone (585) 872-9350 Fax (585) 872-2638
Created by: Paul B-G	DATE: 2-4-2010	Sheet 12 of 12	

Note: The Ohms verification test requires that all four leads are of equal resistance (equal length with identical connectors on each end).

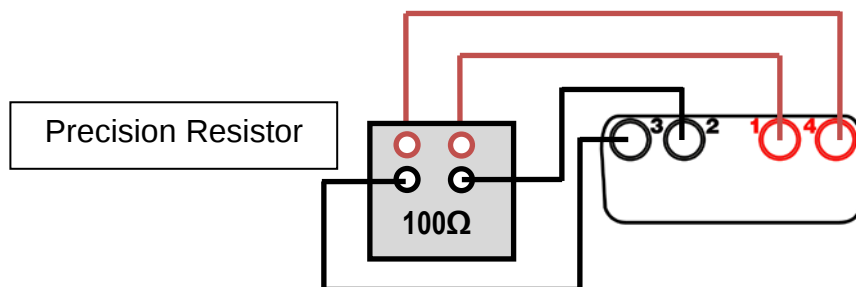
Read 400 Ohms Verification (400 Ω):

- 1) Connect one pair of identifiable test leads to the meter and short the ends. Note this reading (lead wire resistance) for use in steps 3 and 8.
- 2) Connect a precision 100 Ohm resistor to all four Ω terminals.
- 3) Move EZ-CHECK switch to LO (2 W). Verify display is $100.00\ \Omega \pm 0.06\ \Omega$ + (Wire Resistance noted in step 1) Ω .
- 4) Move EZ-CHECK switch to SET (3 W). Verify display reads $100.00\ \Omega \pm 0.06\ \Omega$.
- 5) Move EZ-CHECK switch to HI (4 W). Verify display reads $100.00\ \Omega \pm 0.06\ \Omega$.
- 6) Double click the knob to move to the next function to be calibrated.



Read 4000 Ohms Verification (4000 Ω):

- 7) Connect a precision 100 Ω resistor to all four Ω terminals.
- 8) Move EZ-CHECK switch to LO (2 W). Verify display is $100.0\ \Omega \pm 0.6\ \Omega$ + (Wire Resistance noted in step 1) Ω .
- 9) Move EZ-CHECK switch to SET (3 W). Verify display reads $100.0\ \Omega \pm 0.6\ \Omega$.
- 10) Move EZ-CHECK switch to HI (4 W). Verify display reads $100.0\ \Omega \pm 0.6\ \Omega$.



Completion of Calibration:

Turn the UUC OFF and Move DIP switch 2 (the switch on the right) down toward the batteries (OFF). The next time the unit is turned on the PIECAL will be calibrated and in normal operational mode. Reassemble in reverse order from disassembly.