

μ Tracer 3+ Calibration

GUI version 3.12.6

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Communication Check

1. Switch uTracer power on.
2. Connect the uTracer to the PC.
3. Start the uTracer GUI.
4. Open the Debug/Communications window by pressing the “Debug” button in the “Miscellaneous” section of the main window.
5. Press the “Ping” button.
6. Verify that the Debug form shows the following values:
The “Send” and “Echo” strings should both read 500000000000000000.
In the third row below “Vpower,” the supply voltage should appear.
In the third row below “Vneg,” a value of approximately -40V should appear.

Supply Voltage

1. Connect a DVM across the main power supply.
2. Open the calibration form by pressing “Cal” in the miscellaneous section of the main form.
3. Press “ping” on the debug form and compare the DVM reading to the voltage displayed on the Debug form.
4. If there is a discrepancy, adjust the slider on the calibration form labeled “Vsupp” in the direction to reduce the error (move the slider to the right to increase the display value).
5. Repeat the three previous steps as necessary until the display is in agreement with the DVM reading.
6. Press the “Save to Calibration File” button on the calibration form.

Grid Bias Voltage

1. Connect the positive lead of a DVM to the uTracer’s grid terminal, and the negative lead to the cathode terminal. This assumes that the DVM can read negative voltages. Otherwise, reverse the connections.
2. If previously created, open saved .uts file “cal_grid_bias,” and skip the next step.
3. Select measurement type I(Va, Vg), with Vs, Vh constant, and set measurement parameters for Va Start = 2, Stop = 25, Nintervals = 30, Vg = -40, Vs = 25, Vh = 6.3 [save setup as “cal_grid_bias”]
4. Press “Heater On,” and then “Measure Curve” on the main form, and read actual grid voltage on the DVM. After reading, the measurement can be interrupted by pressing “Abort.” Do not start a new measurement until HV LED is off, or the firmware will hang.
5. Adjust the “Vgrid (40V)” gain slider on the calibration form to close any discrepancy between the DVM reading and the -40V set value (move the slider to the left to increase the measured grid voltage).

6. Repeat the two previous steps as necessary until the measured voltage is as close to -40V as possible.
7. Set the "Vgrid (sat)" slider to 0.96 as a starting value
8. Reset the grid voltage to -4 V.
9. Press "Measure Curve" on the main form, and read the actual grid voltage on the DVM
10. Adjust the "Vgrid (4V)" gain slider on the calibration form to close any discrepancy between the DVM measurement and the -4V set value (move the slider to the left to increase the measured grid voltage).
11. Repeat the two previous steps as necessary until the measured voltage is as close to -4V as possible.
12. Check grid voltages between -0.2 and -1.0, and adjust "Vgrid (sat)" to (possibly) improve calibration in this range.
13. Press the "Save to Calibration File" button on the calibration form.

"Vg Low" Grid Bias Voltage (Low/Positive Vg Loupe Accessory)

1. Connect a DVM to the Loupe accessory's grid bias terminal (positive lead), and to the uTracer's cathode terminal (negative lead). The DVM must be capable of reading both positive and negative voltages.
2. Tick the "Vg low" box in the main form. This is done so the setup file will load correctly.
3. If previously created, open saved .uts file "cal_grid_bias_low_Vg," and skip next step.
4. Select measurement type I(Va, Vg), with Vs, Vh constant, and set measurement parameters for Va Start = 2, Stop = 25, Nintervals = 30, Vg = -10 -5 0 5, Vs = 25, Vh = 6.3 [save setup as "cal_grid_bias_low_Vg"]
5. Press "Measure Curve" on the main form, and read the actual grid voltage on the DVM at the 0V set point. The voltage measurement can be interrupted by pressing "Abort." Do not start a new measurement until HV LED is off, or the firmware will hang.
6. Adjust the "Vg Low B" slider on the calibration form to close any discrepancy between the DVM reading and the 0V set value (move the slider to the left to increase the grid voltage).
7. Repeat the two previous steps as necessary until the measured voltage is as close to 0V as possible.
8. Press "Measure Curve" on the main form, and read the grid voltage on the DVM at the -5V set point.
9. Adjust the "Vg Low A" slider on the calibration form to close any discrepancy between the DVM reading and the -5V set value (moving the slider to the left increases the grid voltage).
10. Repeat the two previous steps as necessary until the measured voltage is as close to -5V as possible.
11. Press the "Save to Calibration File" button on the calibration form.

Boost Converters

1. Connect the positive lead of a DVM to the positive lead of the anode reservoir capacitor C18, and the negative lead to the uTracer's cathode terminal.

2. If previously created, open saved .uts file "cal_boost_converters," and skip the next step. Note: If "Vg Low" is ticked, un-tick it before opening the setup so it will load correctly.
3. Select measurement type I(Va=Vs, Vg), with Vh constant, and set measurement parameters for Va = Vs Start = 100, Stop = 200, Nintervals = 1, Vg = -1, Vh = 6.3. Set Range and Averaging = Auto, Compliance = 200 mA, and Delay = 5 (sec) [save setup as "cal_boost_converters"]
4. Press "Measure Curve" and observe the voltage reading on the DVM during the 200V phase of the measurement and compare it to the 200V set value.
5. Adjust the Va Gain slider on the calibration form in the appropriate direction to close any discrepancy between the DVM measurement and 200V (move the slider to the right to increase the measured voltage).
6. Repeat the two previous steps as necessary until the measured voltage equals 200V.
7. Press the "Save to Calibration File" button on the calibration form.
8. Connect the positive lead of DVM to screen supply capacitor (C13), and repeat steps 4 - 7 for the screen channel, adjusting Vs Gain slider in step 5.

Current Amplifiers

1. Connect a 10k, 1% resistor between the anode terminal and the cathode terminal.
2. Connect a 10k, 1% resistor between the screen terminal and the cathode terminal.
3. if previously created, open saved .uts file "cal_current_amps," and skip next three steps.
4. Select Measurement type I(Va = Vs, Vg), with Vh constant, and set measurement parameters for Va = Vs Start = 195, Stop = 210, Nintervals = 4, Vgs = -1, Vh = 6.3.
5. Set Range Ia = 0 – 40 mA, Is = 0 – 40 mA, Average = 4X, Compliance = 200 mA, and Delay = 0 (sec).
6. Set plot controls: Display Ia on the left Y-axis and Is on right Y-axis. Set all axes scale ranges to manual. Set the X-axis scale range for 190 to 210V, with 2 tick marks. Set both Y-axis scale ranges for 19 to 21 mA, with 2 tick marks [save setup as "cal_current_amps"]
7. Press "Measure Curve" on the main form to start the measurement.
8. Observe the resulting plot and adjust the Ia and Is gain sliders on the calibration form in the appropriate direction so that the traces on the plot pass through 20 mA at 200V (move the sliders to the left to reduce the current reading). Note that the traces will drift downward for approximately 30 minutes after start-up as the uTracer's operating temperature stabilizes.
9. Repeat the two previous steps until both the Ia and Is traces pass through 20 mA at 200V.
10. Press the "Save to Calibration File" button on the calibration form.