# RoeTest – Computer Tube Tester / Tube Measuring System

(c) - Helmut Weigl www.roehrentest.de

**Fine tuning of heater voltage measurement**

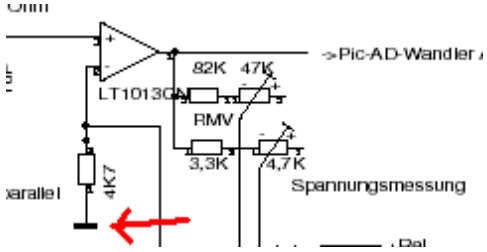
**Problem:**

When a a multimeter is connected to a tube socket and measures are taken (for example the heater voltage in manual mode) the measured value conforms to the display or the RoeTest. If the voltage is loaded (e.g. when inserting a tube with a heater current of 1A) it may happen that the display of the multimeter does not exactly conform with the display of the RoeTest ( the RoeTest for example shows a slightly higher voltage than the multimeter - depending on the current flowing).

**Reason:**

PCBs connectors relay contacts wires etc. have resistance too. If there flows a current across those resistances a voltage is dropped. This is the same with the RoeTest. This (very small) voltage drop can influence the measure value display. Affected is only the low heater voltage range (0 – 12.75V) as with this range accumulate several factors:
high currents flow
the measuring amplifier has a high amplification factor
there is a deviation noticeable in relation to the low voltages (at 300V anode voltage a measure error of 0.1V can be neglected)

The problem of the voltage drop affects the ground line. This line is designed with a wide trace with both on the main board as well as on the heater board but there is nevertheless a voltage drop. This voltage drop may shift the zero point of the measuring amplifier:




Therefore it is crucial where this zero point is connected to on the heater board. Smallest changes at this ground connection change the output value of the measuring amplifier and distort the display.

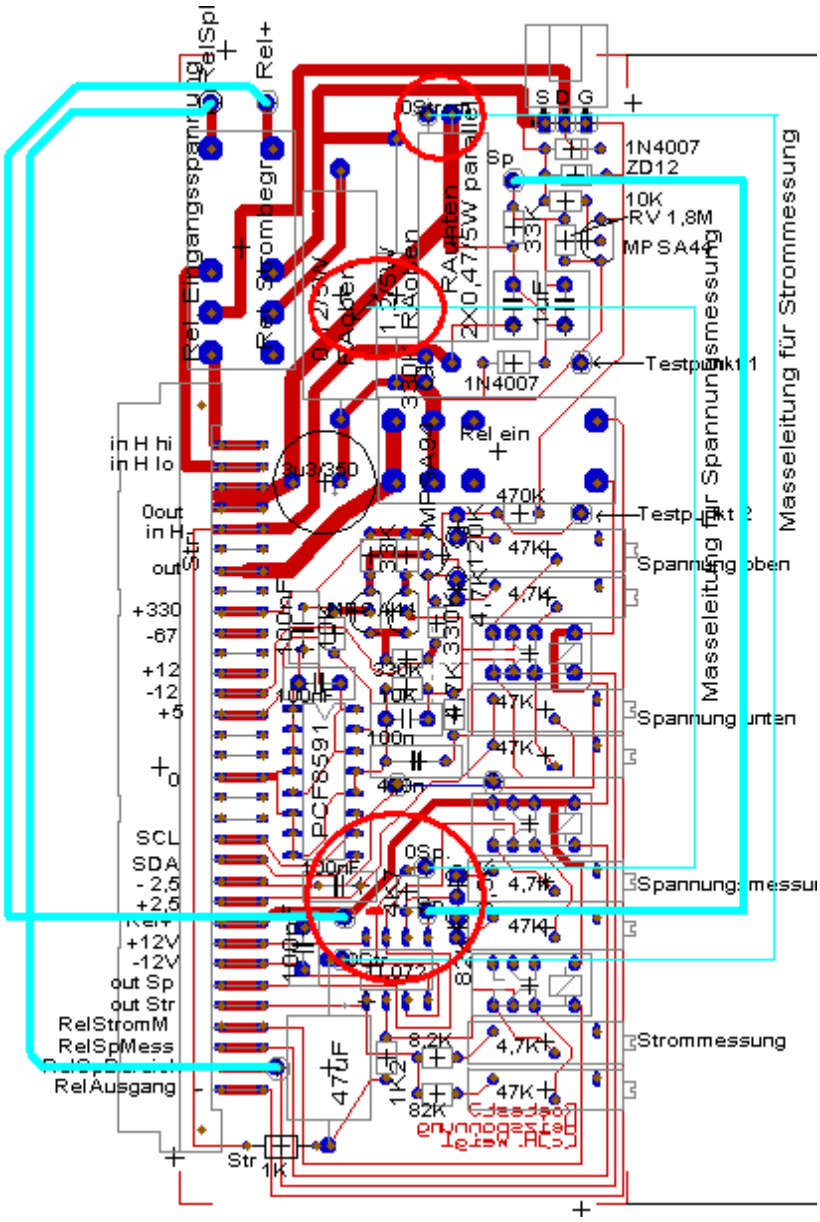
**Solution:**

Choose the correct ground point on the heater voltage board. There is a chance not only to compensate the voltage drop on the heater voltage board but also the voltage drop up to the tube sockets in a simple way.

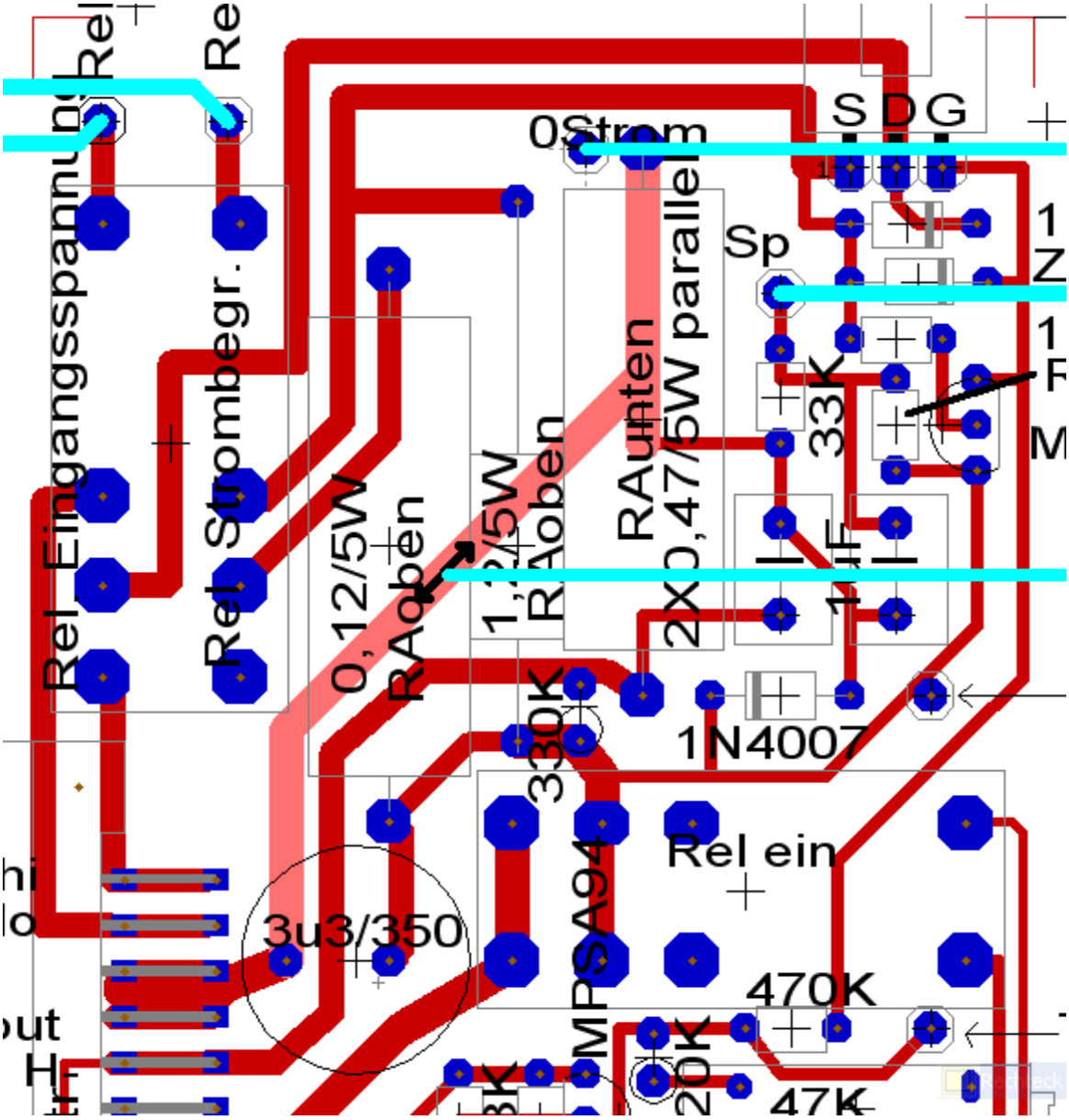
**Approach:**

A little change  is required on the heater voltage board. Separate ground lines are required for current measuring (0Strom) and voltage measuring (0Sp) ( light blue thin lines). A PCB trace must be cut (lower red circle – red line).

NOTEh: This change is  already incorporated in the new layout..The new layout merely requires to solder a a ground wire in a suitable way.




The ground line for the voltage measuring is soldered to the trace shown below (light red). This requires finding the most suitable point on this trace (by trying). **Unbelievable but true: It makes a difference to what piece of the trace the connection is made. Imagine the trace is a potentiometer where a voltage is dropped under load.**
At the top of the light read trace the RoeTest heater voltage instrument displays more than the multimeter at the tube socket. At the bottom end a little bit less (only when loaded).



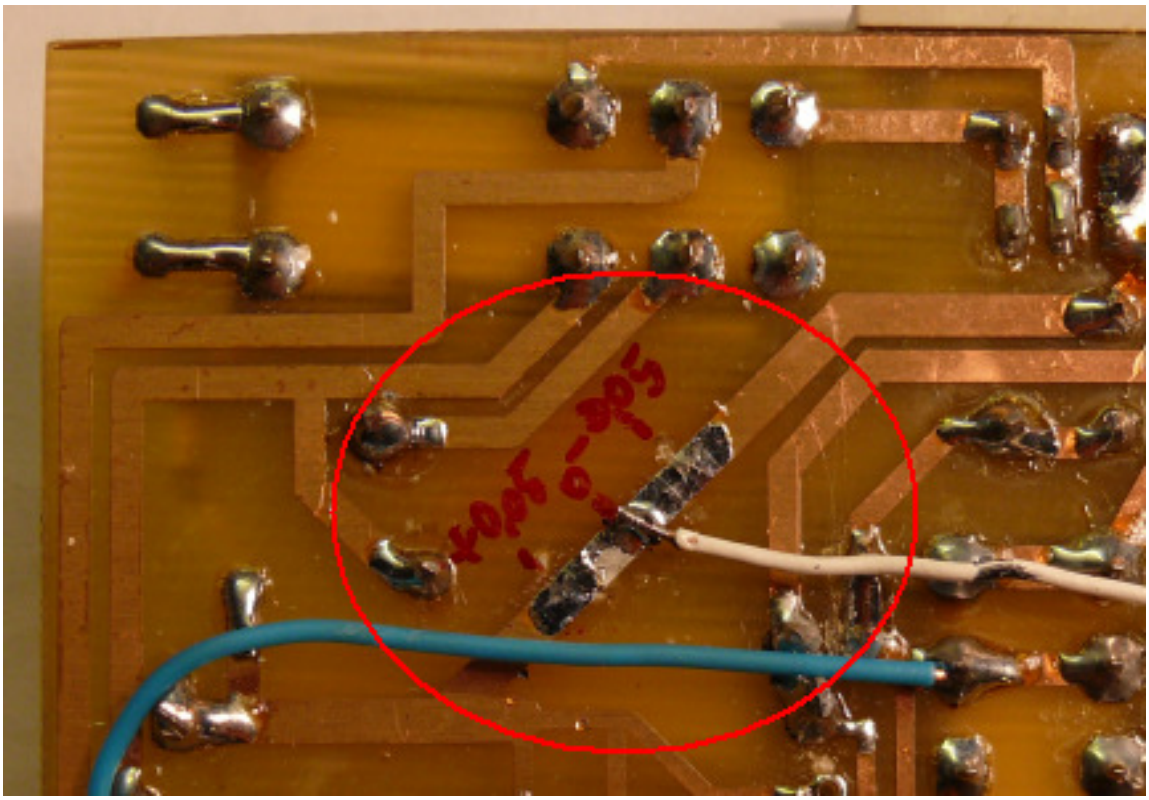

**Approach:**
Select an available tube with a heater current of about 1 A (for example a REN914). Enter manual mode and adjust the slider for the heater voltage (not using automatic control and without the tube) to 4 V. Start and measure the voltage at the tube socket (here pin 2 and 3). If required readjust the trimmer for the heater voltage measuring that multimeter and RoeTest match well (the exact value of the real voltage does not matter, it will be a little bit higher as the heater voltage range has been adjusted with a little load applied).

Now insert the tube so that the heater voltage is loaded. The heater voltage will drop a little bit (please do not readjust the sliders). If the multimeter at the tube socket and the RoeTest show different values now correction is needed.

Disconnect the RoeTest from mains voltage, discharge the capacitors and **solder the ground line for voltage measuring to a different position of the PCB trace**.

Several tries may be needed until the correct position is found. As every build is different it cannot be predicted where the correct ground point is. So try !!!
(Note: Remove unnecessary tin from the trace after each trial else the resistance of the trace would change).

Attached a photo of my ground connection.



Note: In new RoeTest there is a trim pot for adjustment