Simple High-Voltage Probe 1000:1

Introduction

Measurements of HV above 600VDC or 1000VDC with available multimeters are not possible, because their ranges are limited to these values. Expensive dividers (probes) are available on the market, but it is easy to build a probe 1000:1 up to 5kV yourself.



Picture 1 Schematic HV-Probe

Principle and schematic

The probe is designed for modern multimeters with exactly 10MOhm input impedance at DC. 10 resistors, each 10MOhm, 1W (isolated 500V) are connected in series (picture 1). Why 1Watt? 500V @ 10MOhm create 25mW heat dissipation. For best accuracy and thermal stability of measurements, a high nominal power is proposed; but resistors with 500mW should also work. The 5k6 resistor was found during tests, because the pot was at its setting limits. Maybe the MegOhm resistors are also at their limits of tolerance.

This probe is NOT frequency compensated and therefore ONLY for DC and AC up to 60Hz!

Construction

Following pictures show the mechanical construction. An experimental board is cut to fit into the case. It has to be made of epoxy or better (High voltage!), not phenolic paper.

An arrangement of the resistors, fixed but not soldered to the board makes the work easy (picture 2). Before final soldering the MegOhm resistors, a test should be made, so that the board exactly fits into the slots of the case (picture 3). All copper pins, which are not needed, should be removed with a drill for better isolation (picture 4). Leave some pins for the trimpot and the other resistors. Picture 5 shows the final assembly in a fully isolated box, type 1591MBK from Hammond (85x56x25mm) or similar.



Picture 2 First arrangement of resistors with auxiliary soldering only



Picture 3 Test of space inside the box before final soldering



Picture 4 Removal of all not needed copper pins (leave some pins for trimpot)



Picture 5 Inside View

Calibration

With an external DC high voltage source and a reference voltmeter, the trimpot is aligned for exactly 1000:1 indication – e.g. 1kV at the probe's input is shown as 1,000VDC at the meter output @ 10MOhm load.

A calibration with AC 50/60Hz is not always possible, because not all -even modern- multimeters have 10MOhm impedance at AC; i've seen some with only 5MOhm at AC!

But if your DVM has 10MOhm at AC, you can use the 230VAC as a reference:

First measure the 230VAC directly without probe then immediately with the probe and adjust the trimmpot for exactly 1000:1 ratio. Repeat this step several times, because the AC at the wall outlet isn't stable over the time.



Picture 6 Application of probe with multimeter

Lethal danger!

High voltages and charged capacitors may be LETHAL!

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