

Task 1: Quality of High Voltage Measurements

(Laboratory F1-115)

The first group will construct the scale of electrostatic voltmeter C 196 up to 30 kV. The second group will perform the calibration of the range up to 100 kV of the panel kilo-voltmeter by the calibrated measuring instrument. Both groups will be changed during the practice.

A) Construction of 30 kV Voltmeter scale

Create the scale of electrostatic voltmeter C 196 within the range up to 30 kV by spherical sparking gap with sphere diameter 100 mm. The gap distance should be chosen regarding the requirement at least 6 points of corrected flashover voltage in the range up to 30 kV. The deflection α (mm) on the scale of the electrostatic voltmeter will be measured three times for each distance of spark gap to respect probability of discharge in the air. The graphical plot of $U = f(\alpha)$ will be used for the scale construction in the real dimension. Recommended gap distances are: 5, 6, 8, 9, 10, and 12 mm.

$$U = \frac{\delta}{\sqrt{2}} U_{nm}, \quad \delta = 2,89 \frac{b}{273 + \vartheta} \quad b_n = 101,3 \text{ kPa}, \quad \vartheta_n = 20^\circ \text{C}$$

U_{nm} (kV) is the peak voltage value for normal atmospheric conditions (from tables)

U (kV) is the corrected RMS voltage to real atmospheric conditions

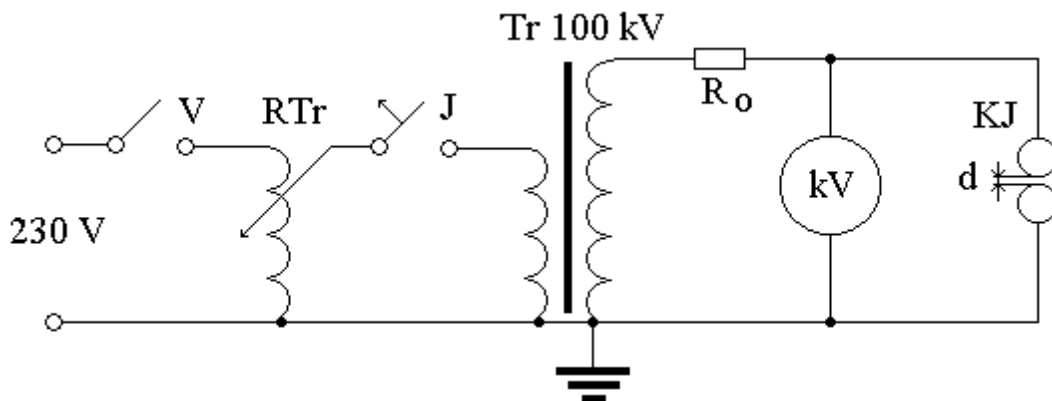
δ (-) is the relative air density

b (kPa) is the atmospheric pressure

ϑ ($^\circ\text{C}$) is the air temperature

α (mm) is the deflection of the electrostatic voltmeter

Measurement circuit:



V – switch

RTr – controlled power transformer

J – breaker

Tr – testing transformer 100 kV

Ro – limiting resistor

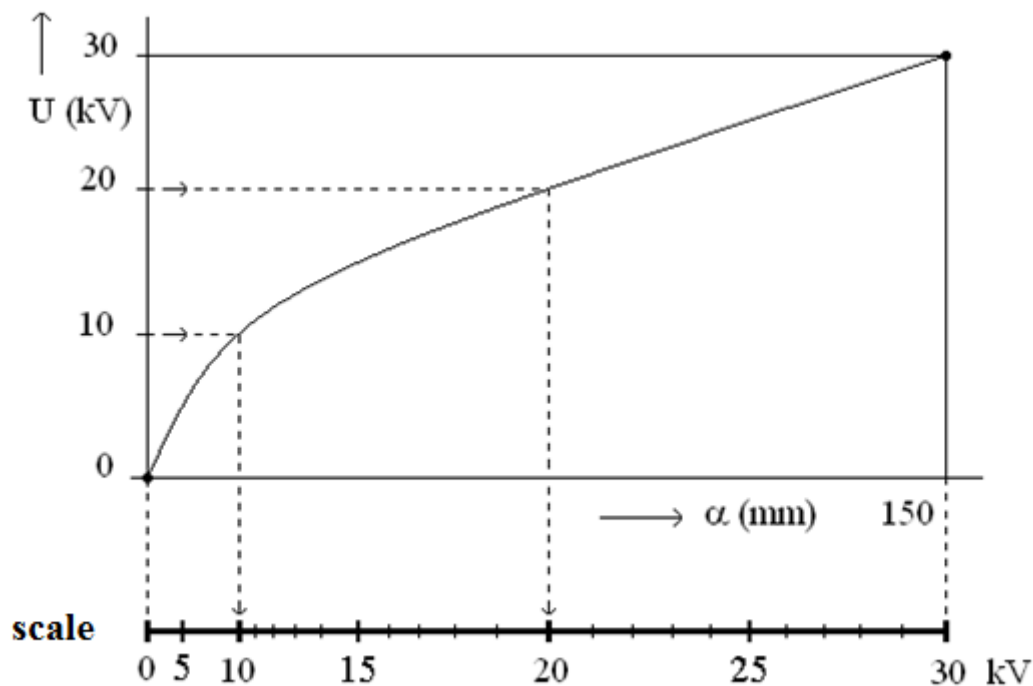
kV – electrostatic kilo-voltmeter

KJ – spherical spark gap with variable distance d

Example of the Table of Measured Values:

KJ d (mm)	KJ U_{nm} (kV)	Correction U (kV)	Voltmeter α_1 (mm)	Voltmeter α_2 (mm)	Voltmeter α_3 (mm)	$\theta \alpha$ (mm)
5						
6						
8						
9						
10						
12						

Example of the Graphical Evaluation of Results:



B) Calibration of panel voltmeter 100 kV

Calibration of 50 kV range of panel voltmeter will be performed by calibrated electrostatic voltmeter Trüb-Täuber with the range up to 100 kV. The measured data should be presented in the form of calibration table. The calibration table will include measured values of both voltmeters, measurement error and uncertainty. Repetitive measurements have to be performed for each voltage setting to determine type A uncertainty. The type B uncertainty is possible to estimate based on the calibration certificate of calibrated electrostatic voltmeter. The final type uncertainty will be the expanded uncertainty of measurement.