



EXPERIMENT PROCEDURE

- Measuring the electric field within a plate capacitor as a function of the distance between the plates.
- Measuring the electric field within a plate capacitor as a function of the applied voltage.

OBJECTIVE

Measure the electric field in a plate capacitor using the electric field meter.

SUMMARY

The electric field meter can be used to measure the electric field within a plate capacitor directly. In this experiment a rotating sectored disc interrupts the electrostatic flux falling on an induction plate, which forms part of a capacitor plate. The voltage pulses that are thereby generated are amplified to give an output voltage, which is then rectified to give a DC voltage that is proportional to the electric field E acting on the induction plate.

REQUIRED APPARATUS

Quantity	Description	Number
1	Electric Field Meter (230 V, 50/60 Hz)	1001030 or
	Electric Field Meter (115 V, 50/60 Hz)	1001029
1	DC Power Supply 450 V (230 V, 50/60 Hz)	1008535 or
	DC Power Supply 450 V (115 V, 50/60 Hz)	1008534
1	Digital Multimeter E	1006809
1	Analogue Multimeter AM50	1003073
1	Set of 15 Safety Experiment Leads, 75 cm	1002843

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BASIC PRINCIPLES

The electric field meter can be used to measure electric fields directly. In front of an induction plate with four sectors in a star-shaped arrangement, a fan-like disc of similar shape is rotated. It continually interrupts the electrostatic flux, and thereby causes periodic induced charges, which are allowed to dissipate through a large resistance. The voltage pulses that are thereby generated are amplified to give an output voltage, which is then rectified to give a DC voltage that is proportional to the electric field E acting on the induction plate.

In the experiment, the electric field strength

$$(1) \quad E = \frac{U}{d}$$

in a plate capacitor is measured using the electric field meter. The applied voltage U and the distance d between the plates are varied in separate experimental runs.

EVALUATION

In applying Equation 1, one must take into account the fact that the induction plate is about 1 mm below the lower capacitor plate. Therefore, Equation 1 must be replaced by:

$$E = \frac{U}{d_{\text{eff}}} = \frac{U}{d + 1 \text{ mm}}$$

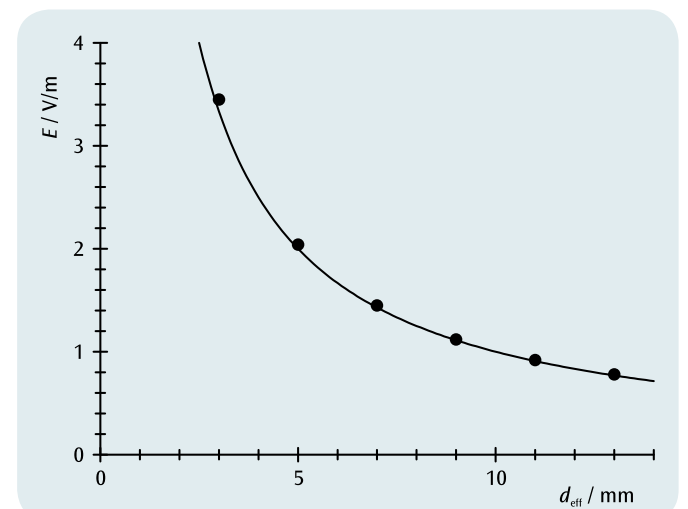


Fig. 1: Electric field inside the plate capacitor as a function of the effective distance between the plates.

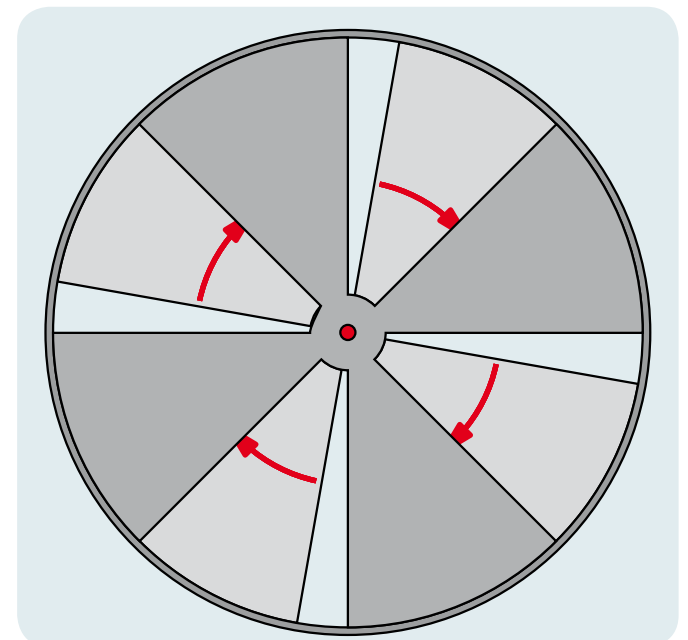


Fig. 2: Rotating sectored disc of the electric field meter.