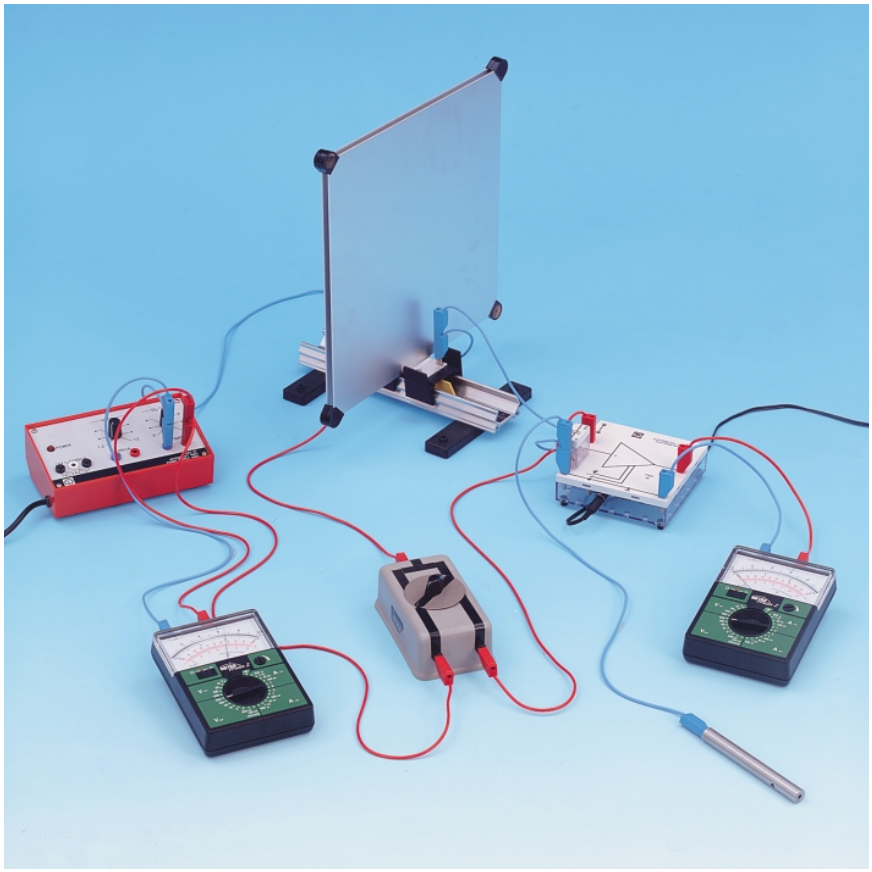
P 3.1.7

Plate capacitor

P 3.1.7.1 Determining the capacitance of a plate capacitor – measuring the charge with the electrometer amplifier

P 3.1.7.2 Parallel and series connection of capacitors – measuring the charge with the electrometer amplifier



Determining the capacitance of a plate capacitor – measuring the charge with the electrometer amplifier (P 3.1.7.1)

A plate capacitor is the simplest form of a capacitor. Its capacitance depends on the plate area A and the plate spacing d. The capacitance increases when an insulator with the dielectric constant ε_r is placed between the two plates. The total capacitance is

$$C = \varepsilon_r \varepsilon_0 \cdot \frac{A}{d}$$

where $\varepsilon_0 = 8.85 \cdot 10^{-12}$ As/Vm (permittivity).

In the first experiment, this relationship is investigated using a demountable capacitor assembly with variable geometry. Capacitor plates with the areas $A = 40$ cm^2 and $A = 80$ cm^2 can be used, as well as various plate-type dielectrics. The distance can be varied in steps of one millimeter.

The second experiment determines the total capacitance C of the demountable capacitor with the two plate pairs arranged at a fixed distance and connected first in parallel and then in series, compares these with the individual capacitances C_1 and C_2 of the two plate pairs. The evaluation confirms the relationship

$$C = C_1 + C_2$$

for parallel connection and

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$$

for serial connection.

Cat. No.	Description	P 3.1.7.1	P 3.1.7.2
544 23	Demountable capacitor	1	1
522 27	Power supply 450 V AC	1	1
504 48	Two-way switch	1	1
531 120	Voltmeter, DC, $U = \pm$ 8 V, e. g. Multimeter LDanalog 20	1	1
531 120	Voltmeter, DC, $U =$ 300 V, e. g. Multimeter LDanalog 20	1	1
532 14	Electrometer amplifier	1	1
578 25	STE capacitor 1 nF, 630 V	1	1
578 10	STE capacitor 10 nF, 100 V	1	1
532 16	Connection rod	1	1
501 45	Pair of cables, 50 cm, red and blue	4	5
501 46	Pair of cables, 100 cm, red and blue	2	2