H27799 Digital Coulombmeter **NFU 218**

Purpose

The digital coulombmeter measures electrical charge in the range +/- 1999nC in 1nC (nanocoulomb) steps.

Specification

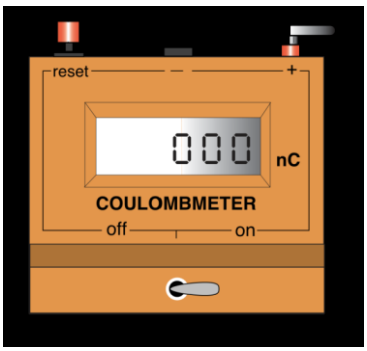
Internal Capacitance: 1µF

Internal Power supply: PP3, 6LR61 or MN1604 battery, may also be powered with a rechargeable PP3 style battery.

For negative charge the display indicates a "-" up to -999nC. Above this value the fourth digit of the display becomes a "1" and polarity is no longer indicated.

For charging by contact, the collecting plate should be fitted into the positive socket, leaving the negative socket free.

The coulombmeter should be stored with the switch in the "off" position to prolong the battery life.



Charging by induction

Additional Equipment:

L02719 Electrostatics kit containing Perspex and plastic strips

Charge the Perspex or plastic rod by friction then bring it up to the coulombmeter collecting plate. Press the RESET button and remove the rod. The reading on the meter will show the opposite sign to the charge on the rod, i.e. a positively charged rod will produce a negative reading on the coulombmeter.

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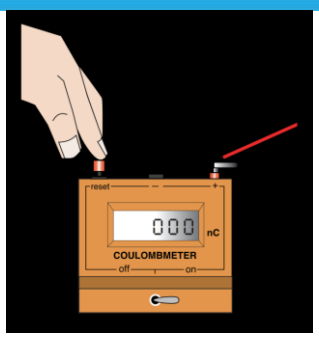


Spooning charge

Additional Equipment

H10520 EHT power supply or
H28305 4.2kV Battery top EHT supply
L02719 Electrostatics Kit

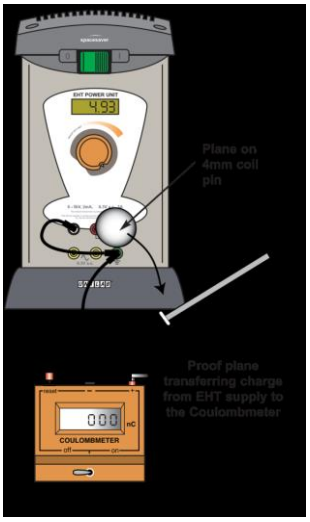
Adjust the EHT power supply to a constant voltage, e.g. 1000V and transfer charge from the collecting plate on the 50MΩ output of the EHT supply to the coulombmeter, the reading will indicate the total charge transferred (charge per transfer x number of transfers).

The relationship Q = CV can be investigated by recording charge for a range of voltages: a graph of these quantities should be linear.

The magnitude of the charge can be increased by using a larger plate, e.g. transfer charge first with a 1p coin and then a 2p coin, stuck to an insulating handle. This may lead to an investigation of a charge to area relationship.

The capacitance of the metal plate/object can be calculated as follows:

C = Q/V if Q = 2nC and V=1000V
Then:
$C = 2 \times 10^{-9} / 10^{3} = 2 \times 10^{-12}$ F
= 2pF (picofarad)



Measuring the charge on a capacitor (charging by contact)

Addition equipment

H27283 Capacitance substitution box
H30658 4-cell holder
4mm leads x 4

The coulombmeter has an input capacitance of 1µF. Charge can only be measured simply on objects whose capacitance is less than 0.01 µF. The capacitance of an object connected to the coulombmeter must be many times less than that of the coulombmeter itself so that almost all of the charge is transferred to the coulombmeter, and only a negligible fraction of the original charge remains on the object. This is because the internal capacitance will be connected in parallel and thus will share the charge. For example, if the test capacitor is also 1µF the reading will only be half that expected.

A 0.01µF (microfarad) capacitor is first charged by connecting it to the battery (6V) with the flying lead and then discharged into the coulombmeter. The reading of charge may be checked against the calculated value, as follows:

Charge = capacitance x voltage
Q = C x V (capacitance in farads)
$Q = 0.01 \times 10^{-6} \times 6$
$Q = 0.03 \times 10^{-6C}$ or 30×10^{-9}
= 30nC (nanocoulombs)

Investigating factors affecting the capacitance of a parallel plate capacitor

Additional Equipment:

H10520 EHT Power Supply
H28305 4.2kV Battery Top EHT Supply
H26783 Parallel Plate Capacitor
4mm leads x 4
Screened lead, as supplied with H26783

The flying lead from the 50MΩ positive output terminal, handled using an insulated rod, is touched on to the insulated plate to charge the capacitor. The charge is measured by touching the screened lead on to the insulated plate.

Various parameters of the parallel plate capacitor which affect the charge can be investigated:

i) the area of overlap of the plates.
ii) the separation of the plates.
iii) the dielectric material which separates the plates.

The above parameters can be used to verify the relationship: C = Q/V = ε0 A/d

0 = permittivity of free space = 8.854 x 10-12 farad metre-1
A = area of overlap, in square metres
d = separation of plates, in metres

Safety advice

For your safety, this product should be used in accordance with these instructions; otherwise, the protection provided may be impaired.

This unit is intended for use in DRY conditions. Avoid spillage of water and other liquids on to the unit. If spillage occurs, disconnect the mains supply.

Disclaimer
If the equipment is used in a way not specified by Philip Harris, then the protection provided may be impaired.

Warranty, repairs and spare parts
The Coulombmeter is guaranteed for a period of one year from the date of delivery to the customer. This warranty does not apply to defects resulting from the action of a user such as misuse, improper wiring, any operations outside of its specification, improper maintenance or repair, or unauthorized modification.

Our liability is limited to repair or replacement of the product. Any failure during the warranty period should be referred to Customer Services.

In the event of a fault, apart from replacing the instrument fuse in the IEC socket, the power supply should be referred to the Philip Harris recommended repair agent.

Disposal of Waste Electrical and Electronic Equipment (WEEE)

Do not dispose of this product with household waste

- For the proper treatment , recovery and recycling please take this product to an appropriate collection point.
- If you are unsure where this is, contact your Local Authority
- By disposing of this product correctly you will be providing positive help to the environment.

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