Charge On Capacitor

Constant Current

EM0965-001 Supplied with LB2624-001 Battery Source

Description:

Using the IEC 'Charge on Capacitor'. The value of a capacitor in microfarads (uF) can be calculated using measurements and first principles.

The charging current is adjusted to be very small and this set current is held constant during the charging. The voltage on the capacitor is monitored be a high impedance digital voltmeter (10 megohms) and the time is checked by the student using a stopwatch.

The 9V battery power source is very small and convenient to use. The currents used are normally less than 1 milliamp, so battery life should be very long.

The unit has pairs of 4mm banana sockets for the following connections:

INPUT: Apply 9V.DC. power from the battery source

OUTPUT: Using a multimeter, to preset the desired charging current and then to connect the sockets to one capacitor to charge it at that preset current.

For full experiment instructions, see later in this sheet

Length: 195mm	Width: 72mm	Height: 60mm	Weight:350g

The Experiment:

The charging current (I) is a constant current that can be adjusted from 2 milliamps down to almost zero. The voltage achieved (V) on the capacitor over the time (t) is measured by a high impedance digital voltmeter while the capacitor is charging. The time (t) is timed by the student with a stopwatch to obtain the time to charge the capacitor from zero volts to 6V.DC..

The formulae to use are as follows:

Capacitance in Farads = Q / V (coulombs / volts))

Coulombs Q = t x A (time x amps)

Therefore, capacitance = (t x A) / V in Farads

Therefore, (10^6 x t x A) / V = capacitance in microfarads (uF).

Step 1) Connect the 9V.DC. power and set the desired charging current. Connect a high impedance digital multimeter (set to milliamps) to the output sockets and adjust the current to read 0.1 milliamp. This current value is typical for the charging rate into a capacitor for this experiment.

Step 2) Remove multimeter from output sockets and short circuit the chosen capacitor for a period of about 10 seconds. This is to be absolutely sure the starting voltage on the capacitor is zero.

Step 3) Connect high impedance digital multimeter (set to volts) across the chosen capacitor.

Step 4) Connect the output sockets also to the chosen capacitor to begin charging the capacitor. The stopwatch must be started at the instant the connection is made. **Be careful of the capacitor polarity.** If connected backwards, the experiment will fail.

Step 5) See the voltage on the capacitor rise over time and document the voltage each second. As soon as 6V is reached, stop the timing.

Strep 6) Note the set current, the final voltage and the time, in seconds, required to charge the capacitor to that 6 volt value. Plot a graph of charging time in seconds (X axis) against capacitor voltage in volts (Y axis).

Apply the formulae above to determine the capacitance of the capacitor in microfarads.

Repeat the experiment, Steps 1 to 6, for the other two capacitors to determine their capacitance.

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