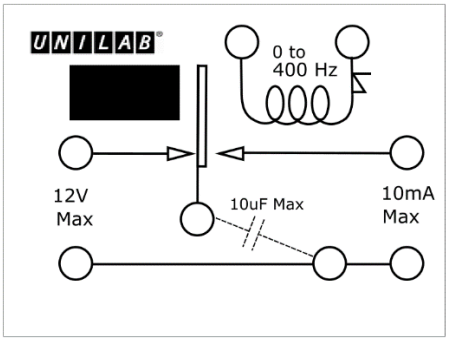
R01326 Reed Relay NFU 529

Purpose **The Unilab Reed Relay is a great way to investigate the charge and discharge of a capacitor and also measure the capacitance of a parallel plate, or fixed, capacitor.**

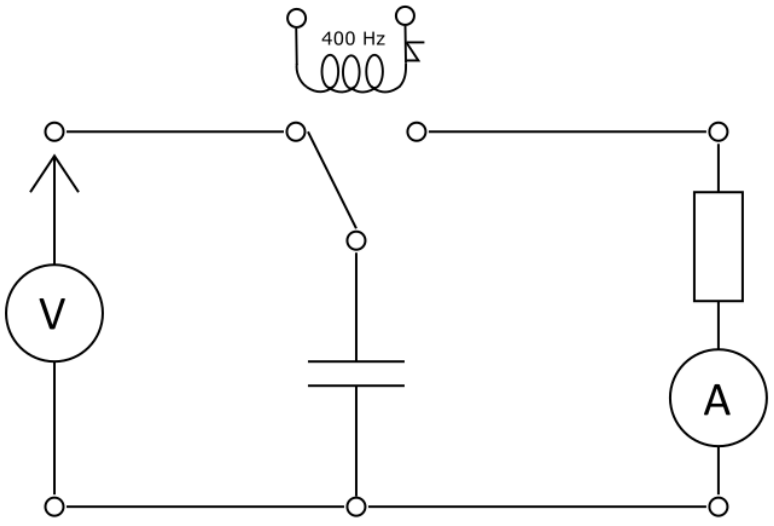
Ratings	**Voltage**	**12V dc Max**
	Current	**10mA Max**
	Capacitance	**10uF Max**
	Frequency	**400 Hz Max**

Operation



The Reed Relay must be driven by a signal generator capable of delivering a 5V square wave at a minimum current of 10mA. The reed switch module is extremely low capacitance and so will contribute a negligible error to any experiment.

Using the Unilab reed switch to measure capacitance



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The theory

As there is a diode in series with it, the reed switch is operated only once per cycle. During the positive half cycle the capacitor is discharged through the ammeter. During the negative half cycle no current flows in the relay coil and the read switch returns to the charging position.

We can use I = Q/t to work out the charge going onto the plates. We also know that f = 1/t, so we can combine the two relationships to give I = Qf, therefore Q = I/f
Since C = Q/V, we can now write C = I/fV

The Experiment

The Unilab reed relay can be used with a parallel plate capacitor (use a 100kΩ protective resistor and a microammeter) or a stock capacitor of around 2.2uF (use a 220Ω protective resistor and a milliammeter). This experiment demonstrates that the charge on a capacitor is proportional to the voltage and a method to determine the value of the capacitance.

Set up the experiment as shown in the diagram above. Set the signal generator to square wave output and a frequency of 350 – 400Hz. Adjust the amplitude until the reed relay can be heard to operate.

Vary the input voltage and record the discharge current. Calculate the Charge Q using the equation Q=I/f. If only a fixed power supply is available the experiment may also be performed by varying the frequency. Complete the table below:

Voltage (V)	Current (A)	Charge (C)

Plot a graph of Q against Voltage and produce a straight line graph. The gradient of the line is the capacitance.

UNILAB Technical Support
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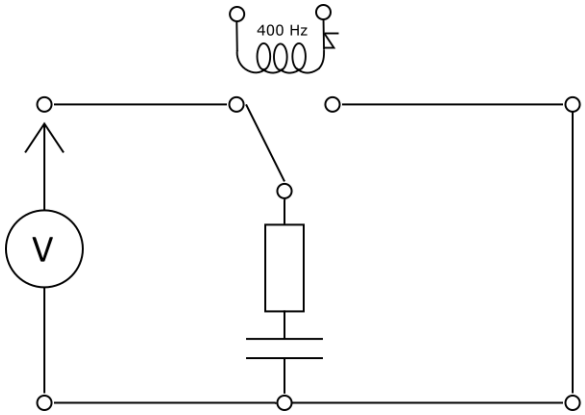
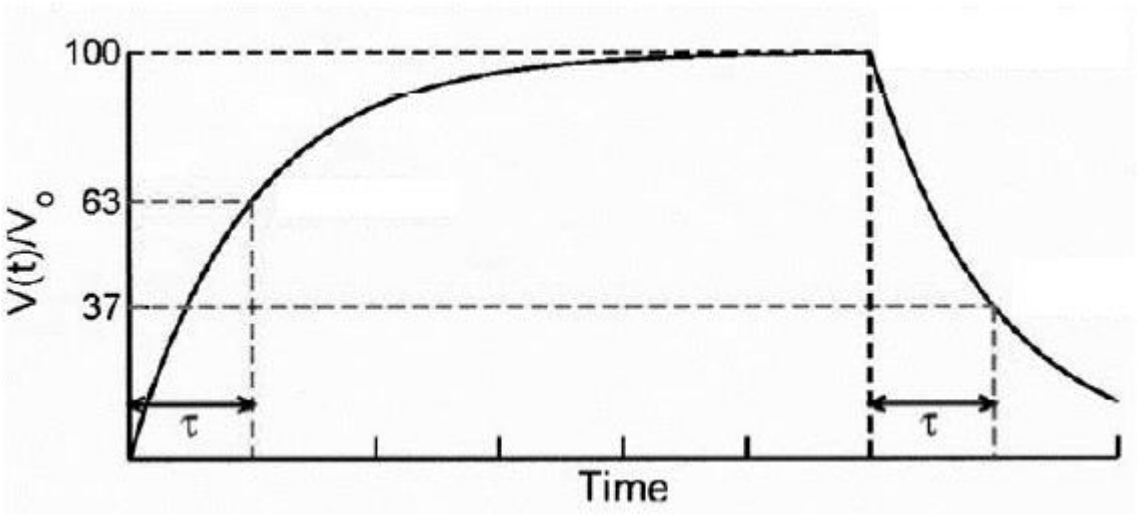
Capacitor Charge/Discharge characteristic



Connecting an oscilloscope across the capacitor is a good way to show the exponential nature of the charge and discharge characteristic. Remove the ammeter and protective resistor from the circuit. Add the protective resistor in series with the capacitor and using a 4mm lead, short the reed relay output to ground. Connect an oscilloscope across the capacitor and adjust the frequency of signal generator until the capacitor just has sufficient time to fully charge and discharge.



τ is known as the time constant and τ=RC. A capacitor that is charging will reach 63% of its final value in one time constant. A capacitor that is discharging will reach 37% of its initial voltage in one time constant. A capacitor is fully charged (or discharged) after five time constants which is another way to measure the capacitance.

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Guidance notes

If using a parallel plate capacitor, do not allow the plates to touch or the resulting high current will damage the reed relay. For accurate results keep hands away from the connecting leads when taking measurements. If using a stock capacitor please ensure that the capacitor is connected with the correct polarity and be aware that the value printed on the capacitor can have a tolerance of -20/+80%

If fixed capacitors are used, the effect of adding capacitors in series and parallel can also be demonstrated.

The Unilab reed relay can also be used to investigate other factors determining the capacitance of a parallel plate capacitor such as the distance between the plates, the area and the dielectric between the plates.

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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.

Warranty, repairs and spare parts:

The Reed Relay 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.

Please contact Customer Services or techsupport@philipharris.co.uk for advice

Supplier details:

Philip Harris Education, 2 Gregory Street, Hyde, Cheshire SK14 4RH

Orders and Information Tel: 0845 120 4521
Fax: 0800 138 8881
Repairs Tel: 0845 120 3211

E-mail: techsupport@philipharris.co.uk

Website: www.philipharris.co.uk

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