Task

To connect up a simple circuit incorporating a filament lamp and familiarize yourself with how the strength of electric current is measured.

Equipment

Plug-in board	06033.00	1
On/off switch	39139.00	1
Lamp holder E10	17049.00	1
Connecting cable, 25 cm, red	07313.01	2
Connecting cable, 25 cm, blue	07313.04	2
Filament lamp, 4V/0.04 A, E10, 1 pc.	06154.03	(1)
Filament lamp, 6V/0.5 A, E10, 1 pc.	35673.03	(1)
Filament lamp, 12V/0.1 A, E10, 1 pc.	07505.03	(1)
Multi-range meter	07028.01	1
Power supply, 0...12 V-,6 V~, 12 V~	13505.93	1

Set-Up and Procedure

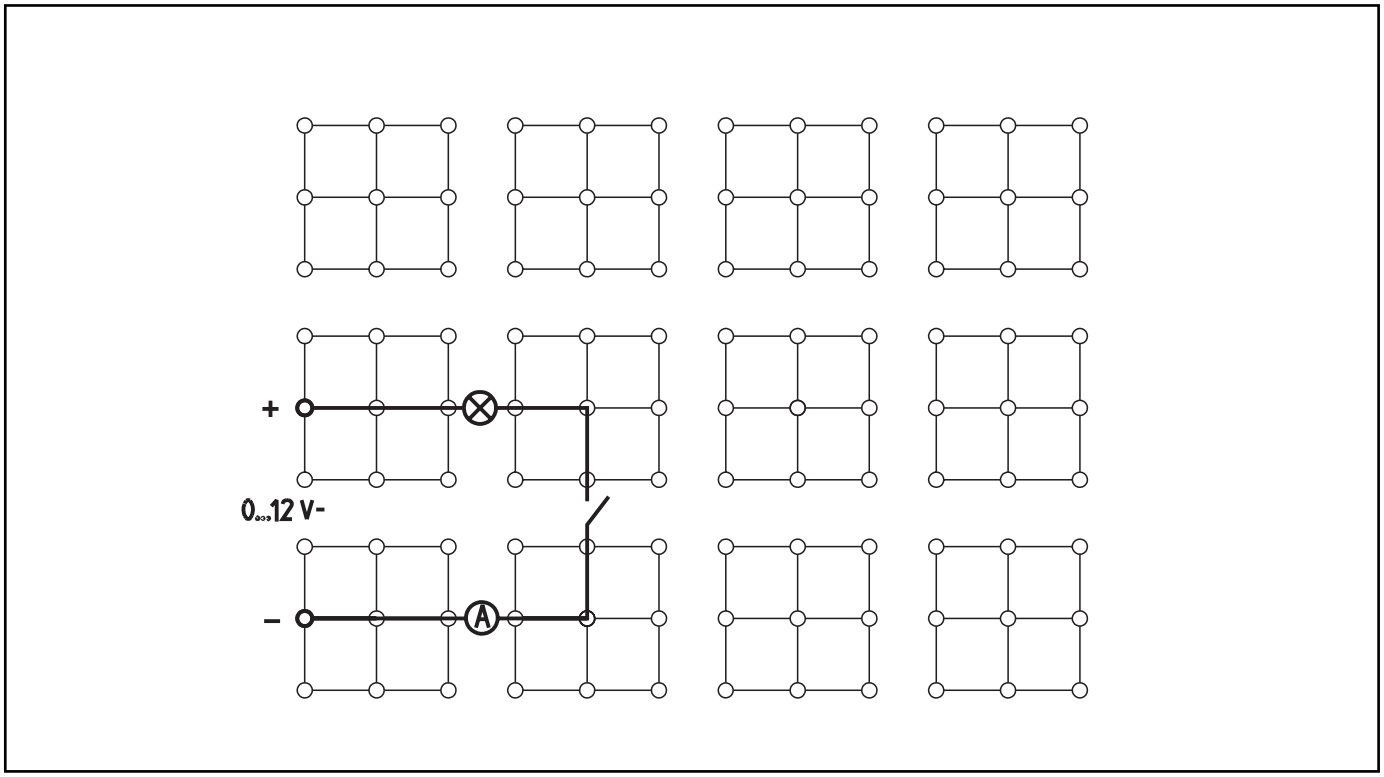
— Connect up the circuit as shown in Fig. 1 and hereby pay attention to the correct choice of connecting sockets and to the correct polarity of the current measuring instrument.
— First screw in the lamp which is of 4 V rated voltage and open the switch.
— Select the 300 mA- measurement range (type of current: direct current; A ⎓).
— Set the power supply to 0 V and switch it on.
— Close the switch in the circuit and slowly increase the voltage of the power supply to 4 V.
— Measure the current strength I (use the correct scale!) and note the measured value in Table 1.
— Open the circuit and replace the 4 V lamp with the 6 V lamp.
— Select the 3 A- measurement range and close the circuit.
— Increase the voltage of the power supply to 6 V, read off the current strength (use the correct scale!) and note the measured value.
— Replace the 6 V lamp with the 12 V lamp, increase the voltage of the power supply to 12 V, read off the current strength and note the measured value.
— Select the 300 mA- measurement range and again measure and note the current strength.
— Switch the power supply off.

Measurement Results

Table 1

U/V	Measuring range	I /mA
4	300 mA	
6	3 A	
12	3 A	
12	300 mA	

Fig. 1



Evaluation

1. How must an instrument for measuring current strength be connected? Explain why.

2. Compare the measured values for the current strength in the 3rd and 4th lines of Table 1, then answer the following questions:
   a) Why are the measured values different, although nothing in the set up of the circuit was changed? Which value is most accurate? Why?

   b) Which rule follows from this for the measurement of current strength -and for the measurement of physical quantities in general?

3. Summarize everything which must be considered when one is to measure current strength.

(How is electric current measured?)

A simple cicuit is examined to introduce the measurement of current strength. It is assumed, that the students understand the term current strength and its unit.
When they know that electric current is defined as the number of freely moving electrons which pass a cross-section of a conductor in a unit of time, they will easily understand that an ammeter must be connected in the circuit.
Notes on Set-Up and Procedure
As the students are not yet practised in handling the multirange meter, they should not start carrying out the experimental procedure until the teacher has controlled the connections they have made.

Measurement Results

Table 1

U/V	Measuring range	I /mA
4	300 mA	0.036
6	3 A	0.470
12	3 A	0.080
12	300 mA	0.095

Evaluation

1. The instrument for measuring current strength must be connected in the circuit (in series with the electrical device), because the current it is to measure must flow through it.
2. a) The measured values are different, because they were measured in different measurement ranges. The measured value which was read from the measurement range 300 mA is more accurate, because the pointer swing is greater in this range, and the error in measurement therefore smaller.
   b) Measurements must be made in a measurement range which is sufficiently large, and with which the reading is near to the high end of the scale.
3. When measuring current strength, the following points must be taken into consideration:
   — The ammeter must be connected in the circuit,
   — the correct connecting sockets must be used,
   — polarity must be correct
   — the actual type of current must to be set with the selection of the measurement range, and
   — the correct measurement range must be selected (if appropriate, first select a high measurement range, then switch down to a smaller, more suitable one).

(How is electric current measured?)

Room for notes