Electricity with the Modular System

Protective low voltage

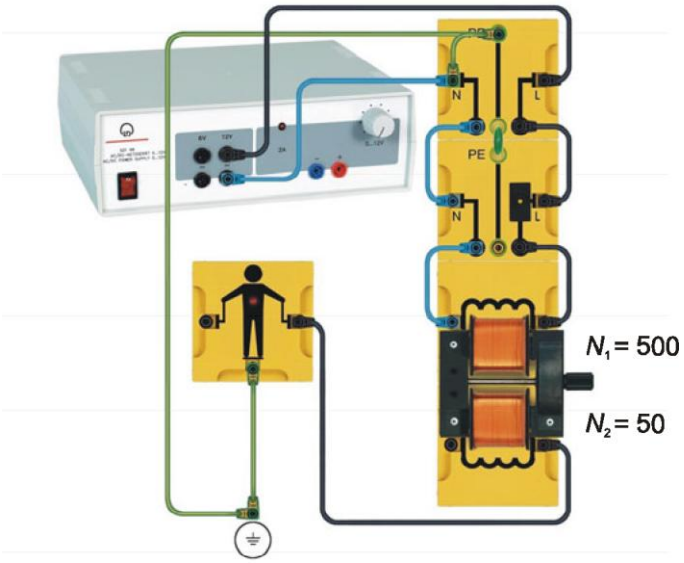
Electrical Safety in the Household

Protective measures

Objective of the experiment

To demonstrate the effect of protective low voltage with single-pole and double-pole contact.

Setup



Apparatus

1	539 087	Model fuse, BST
1	539 089	Model person, BST
1	539 090	Lead component PE, N, L; BST
2	539 052	Coil holder, BST
1	590 86	Coil, 500 turns
1	590 83	Coil, 500 turns
1	593 21	Transformer core, demountable
1	521 49	Power supply, 12 V, AC
2	500 602	Safety connection lead, 10 cm, blue
2	500 604	Safety connection lead, 10 cm, black
1	500 600	Safety connection lead, 10 cm, yellow/green
1	500 591	Safety bridging plug, yellow/green
1	500 622	Safety connection lead, 50 cm, blue
3	500 624	Safety connection lead, 50 cm, black
2	500 640	Safety connection lead, 1 m, yellow/green
Recommended		
1	502 04	Distribution box with earthing socket

D 3.8 2012-02-27

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Carrying out the experiment

- Switch on the power supply (12 V, AC).
- Initially, connect one of the model person’s hands to the phase conductor (L) and their feet to the earth (single-pole contact).
- Observe the light emitting diode on the model person.
- Disconnect their feet from the earth and connect the model person's hands to the phase (L) and neutral conductors (N) (double-pole contact).
- Observe the light emitting diode on the model person.

Observation

The light emitting diode does not light up on the model person for either single-pole or double-pole contact.

Evaluation

Double-pole contact with electrical equipment and installations is not dangerous when the voltage is so low that the current that flows through the human body does not cause any hazardous impact.

Such a contact voltage is called protective low voltage and, like the protective separation, demands both a galvanic separation from the household wiring as well as an unearthed operation (cp. also D 3.8.3.1.a "Protective separation").
In the experiment example, the contact voltage on the secondary winding is:

$$U_2 = \frac{U_1 \cdot N_2}{N_1} = \frac{12\ \text{V} \cdot 50}{500} = 1.2\ \text{V}$$

(voltage ratio at the transformer).

Note:
In practice, protective low voltages should not exceed a voltage of 50 V (AC) and 120 V (DC).

Maximum allowed voltages are: 24 V (AC, DC) for electric toys; 12 V (AC, DC) for devices used in the bath and shower; and 6 V (AC, DC) for medical devices used inside the body.

Protective low voltages can be generated with a safety transformer as in the experiment example (e.g. model railway transformer, low voltage power supply).

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