

# The protective separating transformer (Item No.: P1400500)

## Curricular Relevance

**Area of Expertise:**  
 Physics

**Education Level:**  
 Age 14-16

**Topic:**  
 Electricity

**Subtopic:**  
 Energy supply and environment

**Experiment:**  
 The protective separating transformer

**Difficulty**


Intermediate

**Preparation Time**


10 Minutes

**Execution Time**


10 Minutes

**Recommended Group Size**

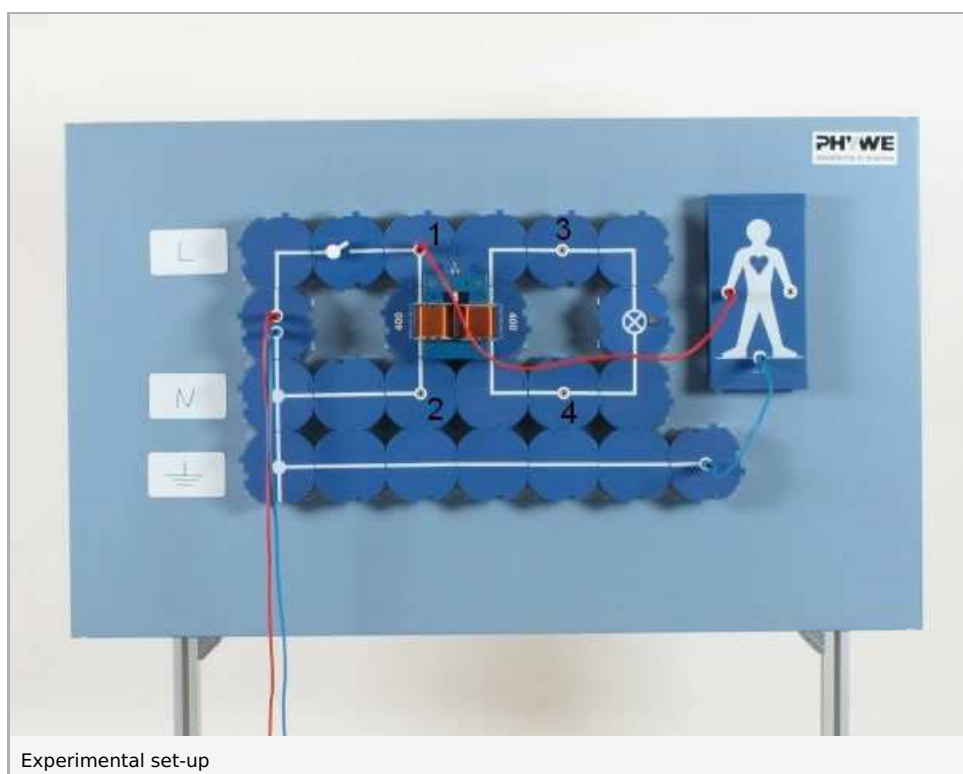

2 Students

**Additional Requirements:**
**Experiment Variations:**
**Keywords:**

## Principle and equipment

### Principle

A demonstration is to be made of how dangers in handling electric current can be reduced by means of a protective separating transformer.



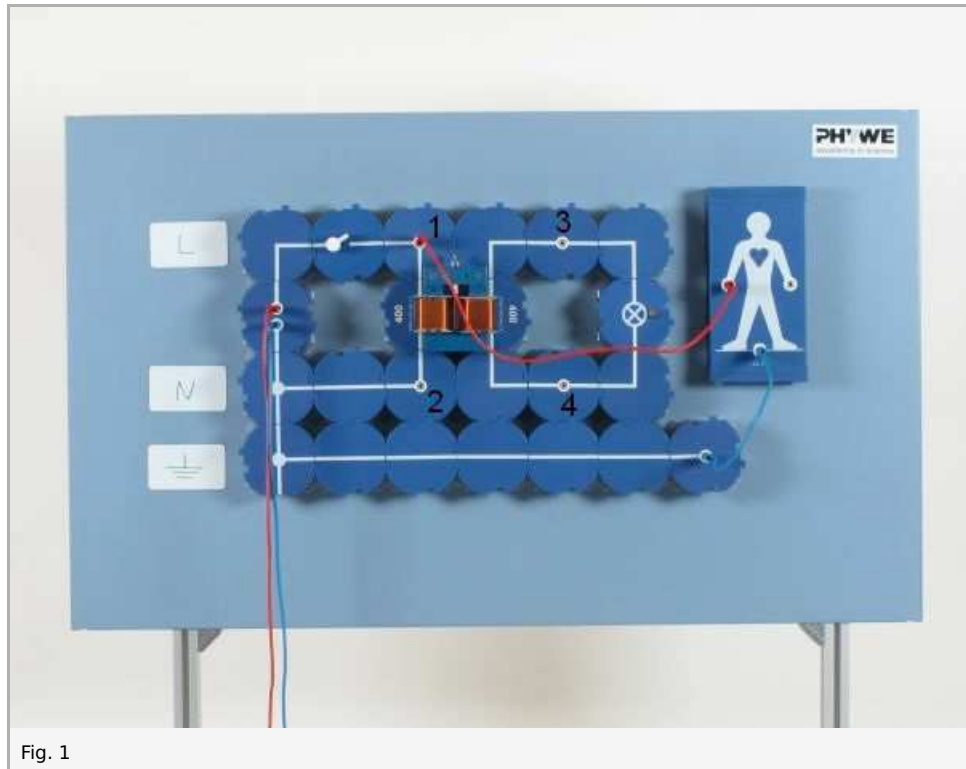
Experimental set-up

## Equipment

Position No.	Material	Order No.	Quantity
1	PHYWE power supply, universal DC: 0...18 V, 0...5 A / AC: 2/4/6/8/10/12/15 V, 5 A	13500-93	1
2	Demo Physics board with stand	02150-00	1
3	Human model f.electric. safety,DB	09480-00	1
4	Coil 400 turns, module DB	09472-01	2
5	Switch on/off, module DB	09402-01	1
6	U-core	07832-00	1
7	Socket for incandescent lamp E10 ,module DB	09404-00	1
8	Connector interrupted, module DB	09401-04	1
9	Junction, module DB	09401-10	1
10	Electr.symbols f.demo-board,12pcs	02154-03	1
11	Yoke	07833-00	1
12	Connector, straight, module DB	09401-01	6
13	Connector, angled, module DB	09401-02	5
14	Connector, T-shaped, module DB	09401-03	2
15	Connect.straight w.socket,mod. DB	09401-11	2
16	Connector, angled with socket, module DB	09401-12	2
17	Filament lamps 12V/0.1A, E10, 10 pieces	07505-03	1
18	Tightening screw	07834-00	1
19	Connecting cord, 32 A, 1000 mm, red	07363-01	1
20	Connecting cord, 32 A, 1000 mm, blue	07363-04	1
21	Connecting cord, 32 A, 750 mm, red	07362-01	1
22	Connecting cord, 32 A, 750 mm, blue	07362-04	1

## Set-up and procedure

- Set up the experiment as shown in Fig. 1; label the upper lead in the primary circuit as L-conductor (L = line) and the lower lead as N-conductor (N = neutral), press the transformer U-core and yoke tightly together with the tightening screw
- Close the switch
- Connect one hand of the human model successively to the measuring positions 1 and 2 and observe the model human (1)
- Connect the hand to measuring position 3 in the secondary circuit and observe the model human (2)



- Repeat the latter step for measuring position 4 (3)
- Interrupt the connection of the human model to earth
- Connect one hand of the human model to measuring position 3 and the other hand to measuring position 4, observe the model human (4)

## Observation and evaluation

### Observation

1. The diodes in the human model light up, as long as the hand touches measuring position 1. They do not light up when measuring position 2 is touched.
2. The diodes do not light up.
3. The diodes do not light up.
4. The diodes light up.

### Evaluation

The human model is only exposed to dangerous voltage when connection is made between the L-lead (measuring position 1) and earth, or between the ends of the secondary coil of the transformer (measuring positions 3 and 4).

When a separating transformer is used, there is no conductive connection between the "line circuit" and the "consumer circuit", and so also none between the "consumer circuit" and earth. When a person touches a noninsulated part of the part of the "consumer circuit", then he or she is protected by the transformer, which is why this is called a protective separating transformer.

### Remarks

The reason why the last part of the experiment is recommended is to make the students aware of the fact that, despite the separation from the line circuit, because of  $U_1:U_2 \approx 1:1$  in the "consumer circuit", the danger still remains should someone touch both leads simultaneously.