# The shunt circuit motor (Item No.: P1398700)

## Curricular Relevance

| Area of Expertise: | Education Level: | Topic: | Subtopic: | Experiment: |
|---|---|---|---|---|
| Physics | Age 14-16 | Electricity | Electric generator, motor, transformer | The shunt circuit motor |

| Difficulty | Preparation Time | Execution Time | Recommended Group Size |
|---|---|---|---|
| Intermediate | 10 Minutes | 20 Minutes | 2 Students |

**Additional Requirements:**

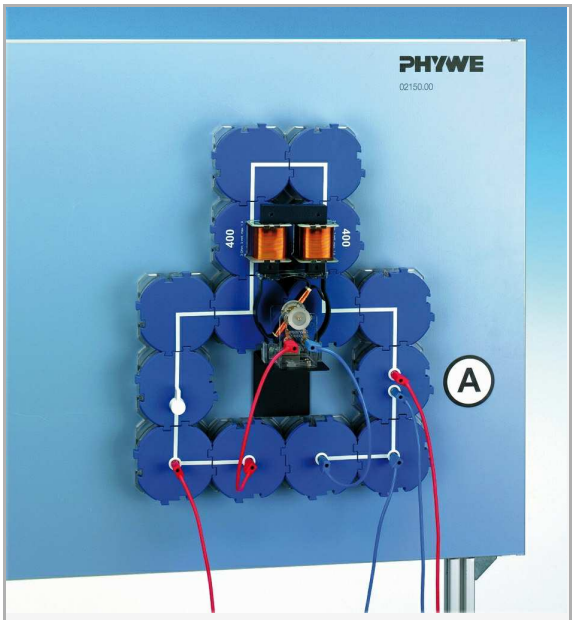
**Experiment Variations:**

**Keywords:**

## Principle and equipment

### Principle

A model of a motor is to be used to demonstrate the construction and functioning of a shunt circuitmotor.




Experimental set-up

## Equipment

| Position No. | Material | Order No. | Quantity |
|---|---|---|---|
| 1 | Multimeter ADM2, demo., analogue | 13820-01 | 2 |
| 2 | 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 |
| 3 | Demo Physics board with stand | 02150-00 | 1 |
| 4 | Motor model f. magnet board | 07850-20 | 1 |
| 5 | Coil 400 turns, module DB | 09472-01 | 2 |
| 6 | Switch on/off, module DB | 09402-01 | 1 |
| 7 | U-core | 07832-00 | 1 |
| 8 | Connector interrupted, module DB | 09401-04 | 3 |
| 9 | Junction, module DB | 09401-10 | 4 |
| 10 | Electr.symbols f.demo-board,12pcs | 02154-03 | 1 |
| 11 | Connector, straight, module DB | 09401-01 | 5 |
| 12 | Connector, angled, module DB | 09401-02 | 6 |
| 13 | Connector, T-shaped, module DB | 09401-03 | 2 |
| 14 | Connector, angled with socket, module DB | 09401-12 | 2 |
| 15 | Holder f.electr.motor,magn.board | 07849-00 | 1 |
| 16 | Connecting cord, 32 A, 1000 mm, red | 07363-01 | 1 |
| 17 | Connecting cord, 32 A, 1000 mm, blue | 07363-04 | 1 |
| 18 | Connecting cord, 32 A, 500 mm, red | 07361-01 | 2 |
| 19 | Connecting cord, 32 A, 500 mm, blue | 07361-04 | 2 |
| 20 | Connecting cord, 32 A, 750 mm, red | 07362-01 | 2 |
| 21 | Connecting cord, 32 A, 750 mm, blue | 07362-04 | 2 |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## Set-up and procedure

- Set up the experiment as shown in Fig. 1 with the switch open; place the motor model on the holder and screw it tight, then position it below the coil with the U-core

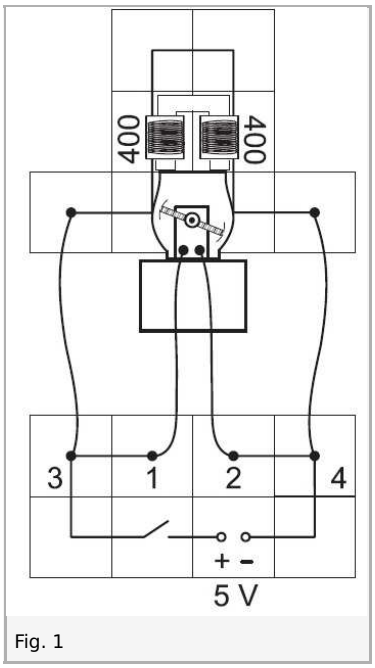

Fig. 1

- Apply a voltage of 5 V- and adjust the armature of the motor to an inclined position
- Close the switch; give the armature a slight push if necessary and notice the direction of rotation of the armature
- Open the switch and reverse the polarity of the operating voltage; close the switch and observe the armature (1)
- Increase the voltage to approx. 7 V-, then reduce it to approx. 3 V-; observe the direction of rotation of the armature (2)
- Open the switch; reverse the polarity of the armature by changing over the contacts 1 and 2; set to the original voltage, close the switch, observe the direction of rotation of the armature and compare it with the direction that it had previously (3}
- Change the polarity of the armature back to what it was originally; now reverse polarity of the field coils by changing over contacts 3 and 4; again observe the direction of rotation of the armature and make a comparison (4)
- With the switch open, set an alternating voltage of 8 V-; close the switch and observe the motor (5)
- Change the experimental set-up to that in Fig. 2; set the ammeters to the 300 mA- measurement range (for the armature current) and 1 A- (for the field current)

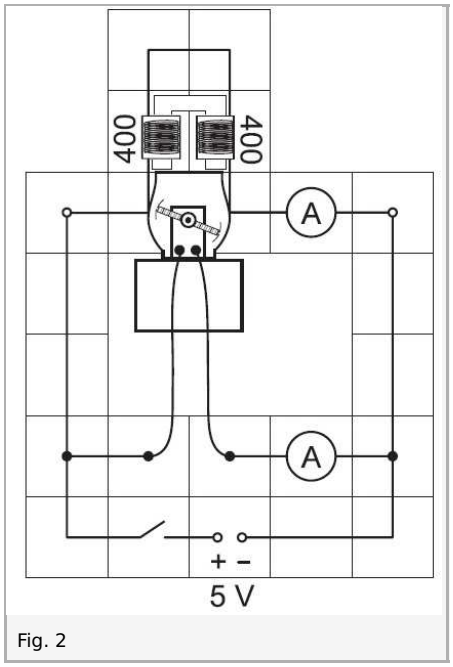

Fig. 2

- Close the switch and put a load on the motor by finger braking the front belt pulley; thereby observe the speed of rotation

and the behaviour of the ammeters (6)

# Observation and evaluation

## Observation

1. The direction of rotation of the armature does not change when the polarity of the operating voltage is reversed.
2. The speed of rotation of the armature is greater the higher the operating voltage
3. When the polarity of the armature is reversed with the direction of the operating voltage unchanged, then the armature reverses its direction of rotation.
4. When the polarity of the field coils is reversed, with the direction of the operating voltage unchanged, the direction of rotation of the armature is reversed.
5. The motor also runs when it is operated with alternating current
6. When the motor is under load, the speed of rotation of the armature is reduced; the armature current increases from about 180 mA to about 300 mA and the field current does not (or hardly) changes.

## Evaluation

A shunt circuit motor has the armature coil and the field coils (rotor and stator coils) switched in parallel. The motor runs (somewhat) quicker when the operating voltage is increased.

When the motor is under load, the operating current increases (almost only by the increase in the armature current); the field current hardly changes. As a result of the increase in the armature current under load, the moment of rotation of the armature increases, and the performance of the motor so adjusts itself to the load.

The shunt motor can also be operated with alternating current, because then the poles in the stator and rotor are simultaneously periodically exchanged.

### Remarks

Shunt motors have a lower performance than main circuit motors. On the other hand, with not too great load fluctuations, they run more evenly than main circuit motors and are suitable as drives that require as unchanged revolution speeds as possible (e.g. for machine tools and lifts).

Like main circuit motors, shunt circuit motors are also called all-current motors or universal motors, because they can beoperated with direct or alternating current.


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