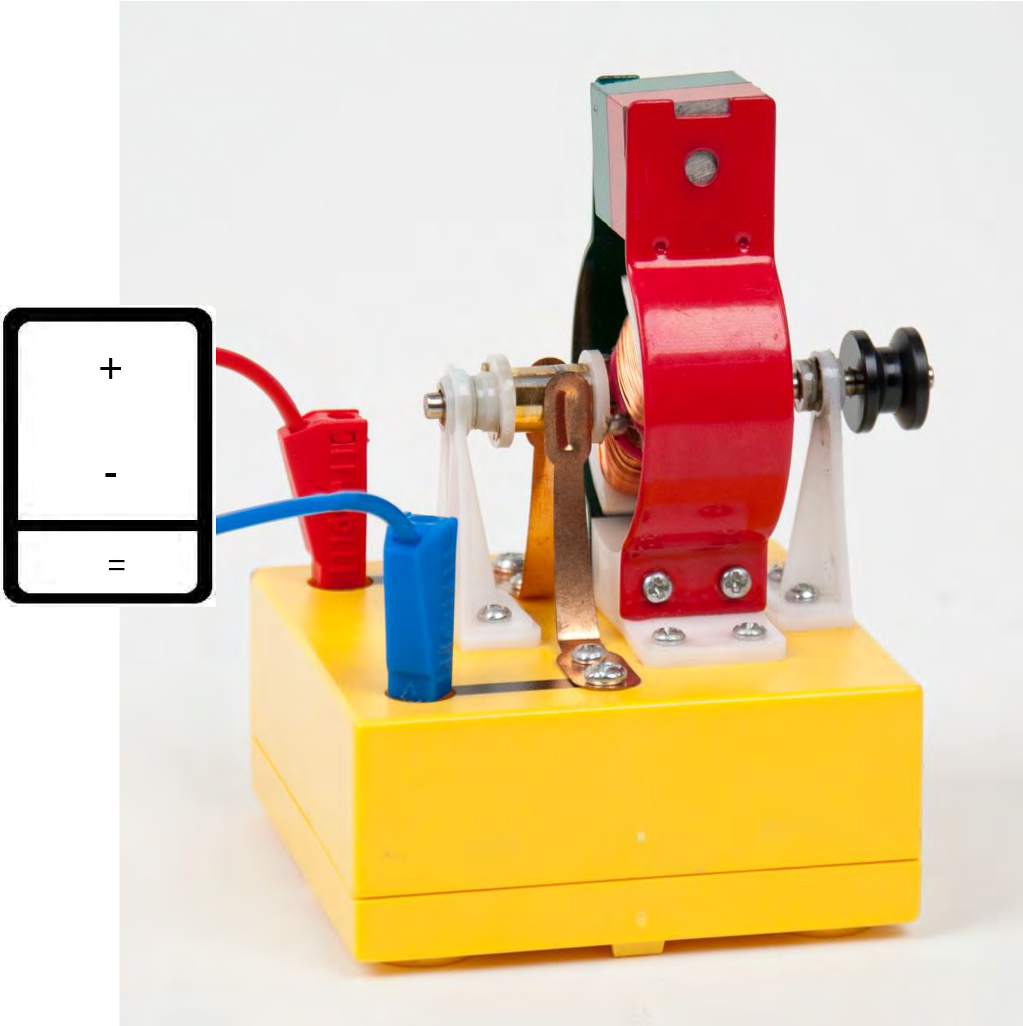
SIMPLE DC MOTOR

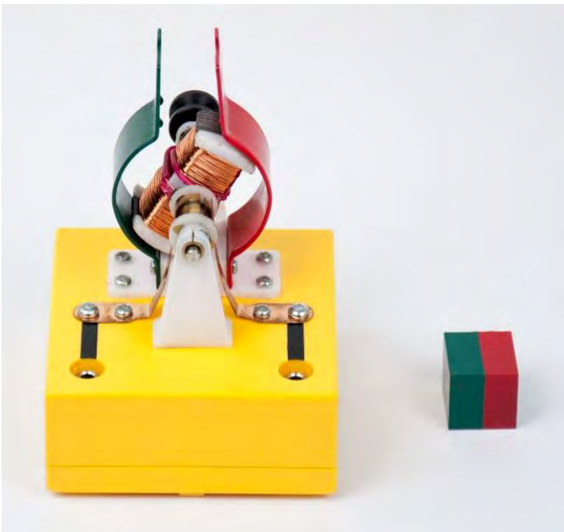
EMS 4.1

Required Kits:
P9901-4D Electricity 1
P9902-5T Electrodynamics



Material:

Item Code	Qty	Description
P3806-1M	1	Motor - Generator model "compact"
P3310-3A	1	Connecting lead SE, 50 cm, red
P3310-3B	1	Connecting lead SE, 50 cm, blue



Additionally required:

	1	Measuring device
	1	Power supply

SIMPLE DC MOTOR

EMS 4.1

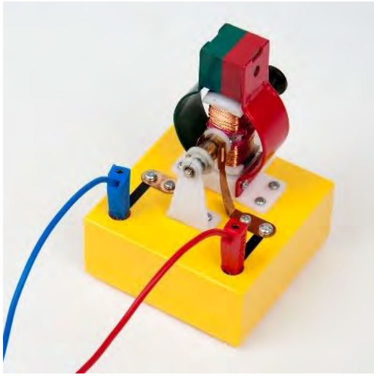
Experimental target:

Understanding of the functioning of a DC motor

Setup:

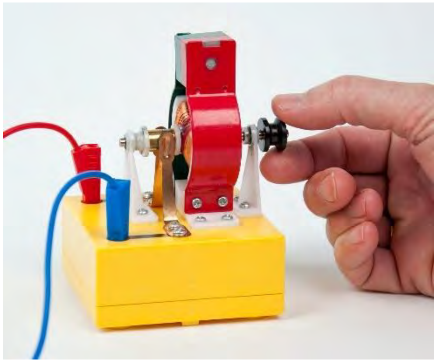
Clamp the small block magnet between the pole plates.
Connect the power supply unit (DC output) to the motor model with connecting leads.

Turn the rotor into a vertical position, so that the brushes on the collector cannot create a short circuit at the beginning.



1. Experiment:

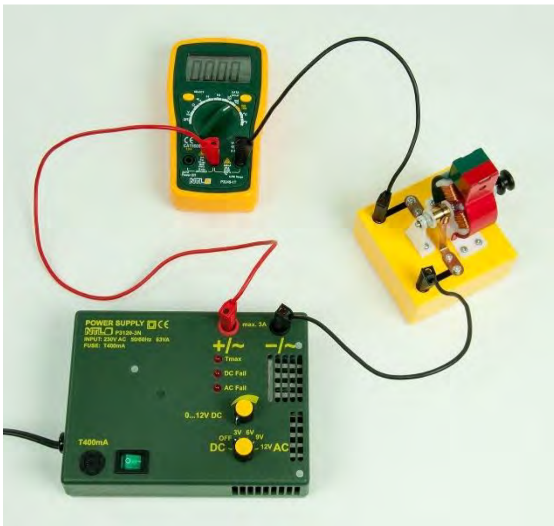
Apply a DC voltage of 2 - 3 V (the polarity gives the direction of rotation) and observe the direction of rotation of the rotor.



Since it is a two-pole rotor, it is possible that it does not start to rotate by itself. If this is the case, the rotor must be set in motion briefly by hand, then it will start.

We now swap the connecting leads on the motor model and reverse the polarity. The rotor is placed vertically and the motor is supplied with voltage again.
What is the direction of rotation of the rotor now?

We turn the block magnet 180° and repeat the experiment.
What is the direction of rotation of the motor now?



2. Experiment:

If we connect a measuring device in series, we can measure the current in the unloaded state.

By slightly compressing the drive shaft of the rotor axle, we slow it down. We thus cause a "load".

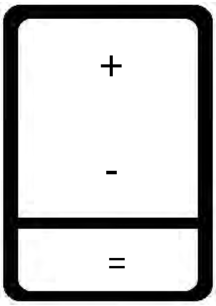
We compare the current demand in loaded and unloaded condition.

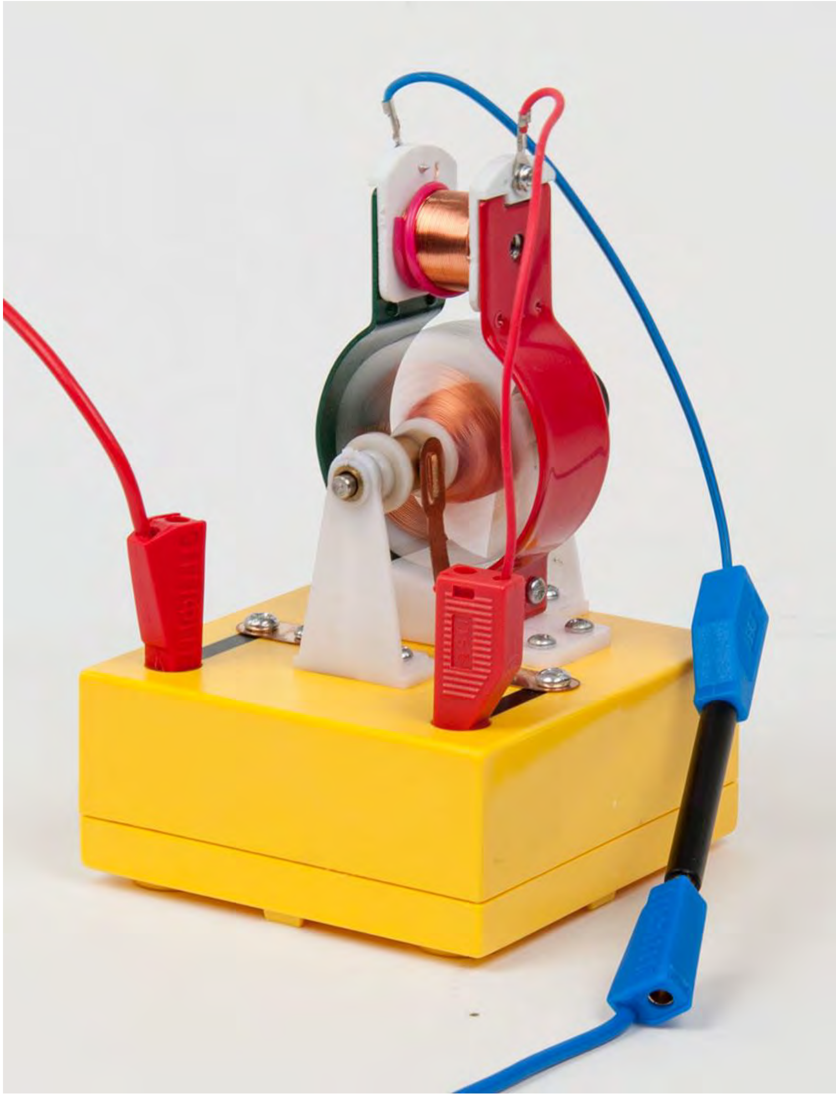
If necessary, the voltage can be increased to about 4 - 5 V DC.

SERIES MOTOR

EMS 4.2

Required Kits:
P9901-4D Electricity 1
P9902-5T Electrodynamics

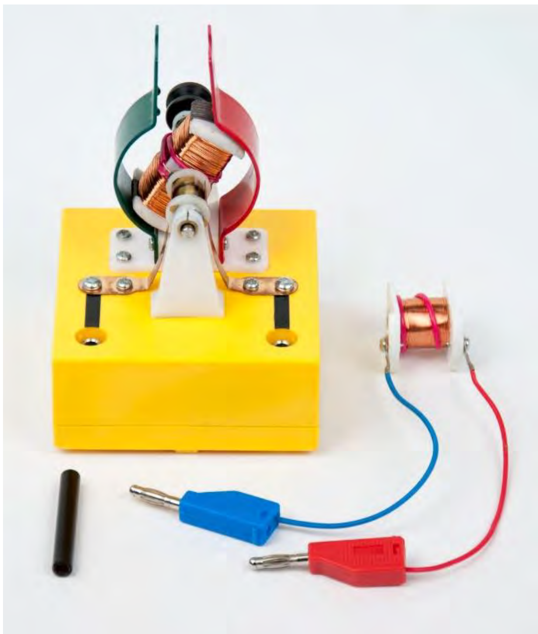




Material:

Item Code	Qty	Description
P3806-1M	1	Motor - Generator model "compact"
P3310-3A	1	Connecting lead SE, 50 cm, red
P3310-3B	1	Connecting lead SE, 50 cm, blue
DG500-4S	1	Double socket, insulated, black

Additionally required:
1 Power supply



SERIES MOTOR

EMS 4.2

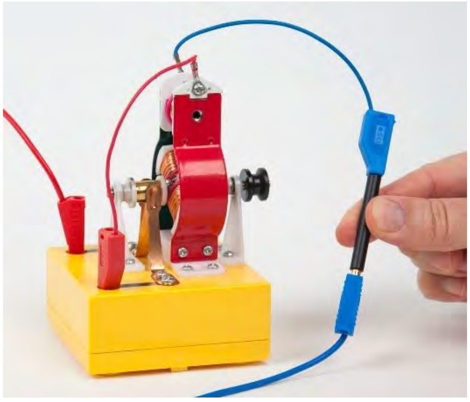
Experimental target:

Understanding of the construction and operation of a series- or main-circuit motor

Setup:

Clamp the small coil with iron core between the pole plates. For the main shunt motor, wire the rotor and the electromagnet in series (see fig.).

Place the rotor vertically so that the brushes on the collector cannot create a short circuit at the beginning.

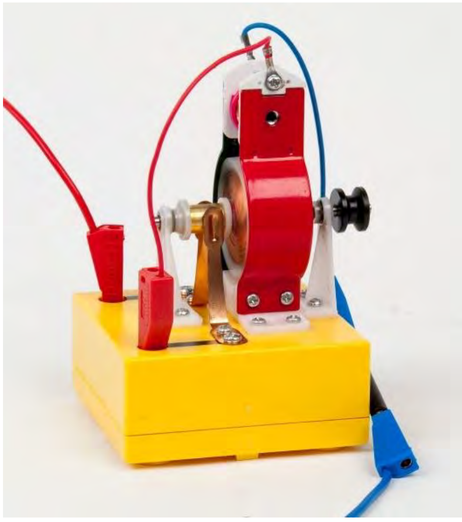


1. Experiment:

Apply about 4 - 5 V DC and observe the rotation of the armature.
If necessary, start the armature.

We now swap the connecting leads on the motor model and thus reverse the polarity. The rotor is placed vertically and the motor is supplied with voltage again.

What is the direction of rotation of the rotor now?



2. Experiment:

We now apply an AC voltage of 9 V and observe whether this motor type also runs with AC.

If the rotor does not start to run on its own, it must be made to rotate with the fingers.

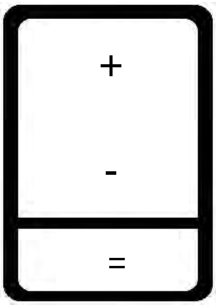
Note:
In contrast to the DC motor, the main shunt motor (armature and field winding are connected in series) can also be operated with alternating current (AC). The current direction changes simultaneously in the armature and field winding!

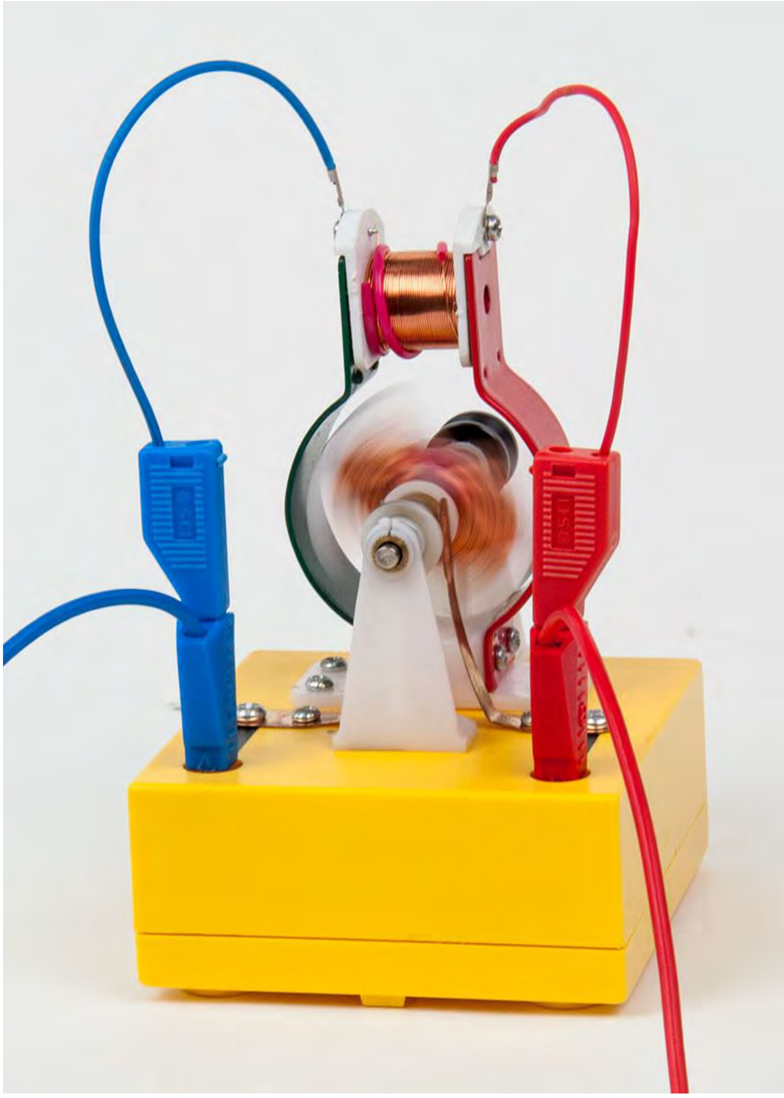
However, a higher voltage is required for commissioning with alternating current (AC) because the alternating current (AC) resistance of the coils is greater than the direct current (DC) resistance.

SHUNT-WOUND MOTOR

EMS 4.3

Required Kits:
P9901-4D Electricity 1
P9902-5T Electrodynamics



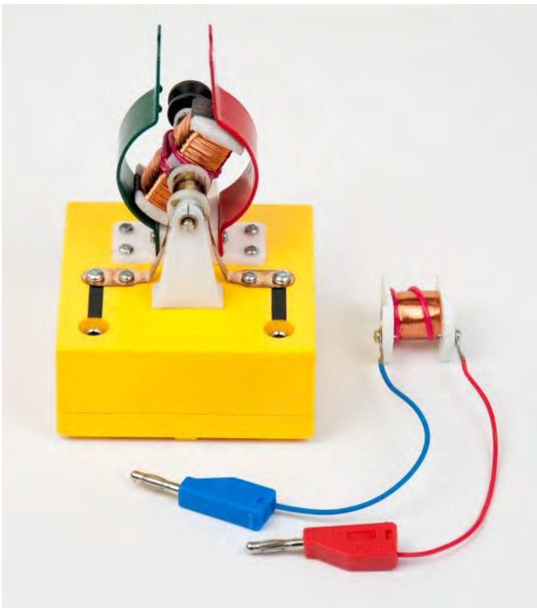


Material:

Item Code	Qty	Description
P3806-1M	1	Motor - Generator model "compact"
P3310-3A	1	Connecting lead SE, 50 cm, red
P3310-3B	1	Connecting lead SE, 50 cm, blue

Additionally required:

	1	Power supply



SHUNT-WOUND MOTOR

EMS 4.3

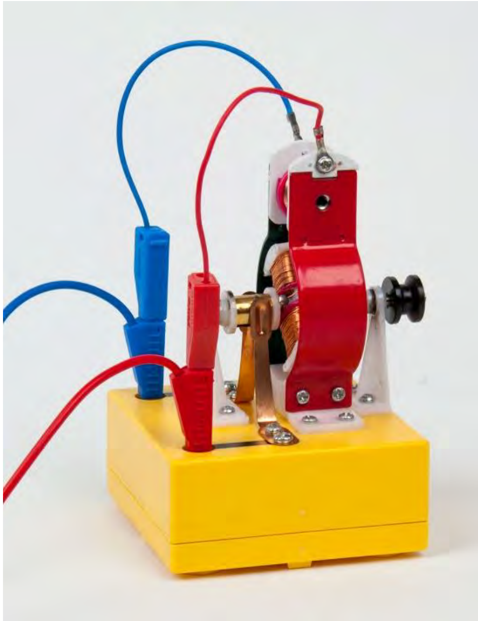
Experimental target:

The tuning of external and internal anchor field

Setup:

Clamp the small coil with iron core between the pole plates. For the shunt motor, wire the rotor (inner field) and the field coil (outer magnetic field) in parallel (see fig.).

Place the rotor vertically so that the brushes on the collector cannot create a short circuit at the beginning.

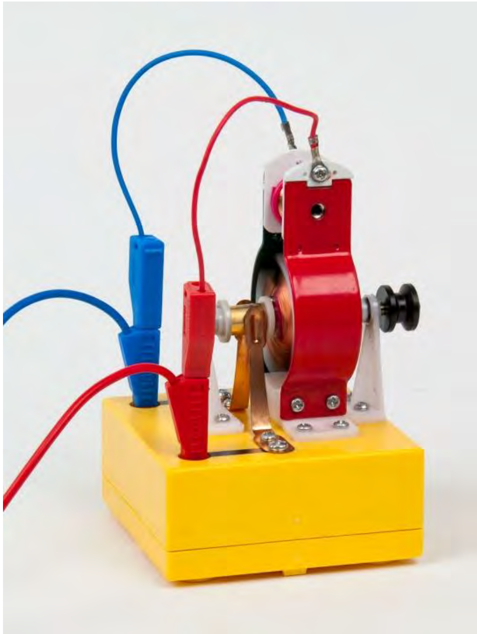


Experiment:

Apply approx. 1.5 - 3 V DC and observe the rotation of the armature.
If necessary, start the armature.

We now swap the connecting leads on the motor model, thereby reversing the polarity. The rotor is placed vertically and the motor is supplied with voltage again.

What is the direction of rotation of the rotor now?



DC GENERATOR –
EXTERNAL POLE GENERATOR

EMS 4.4

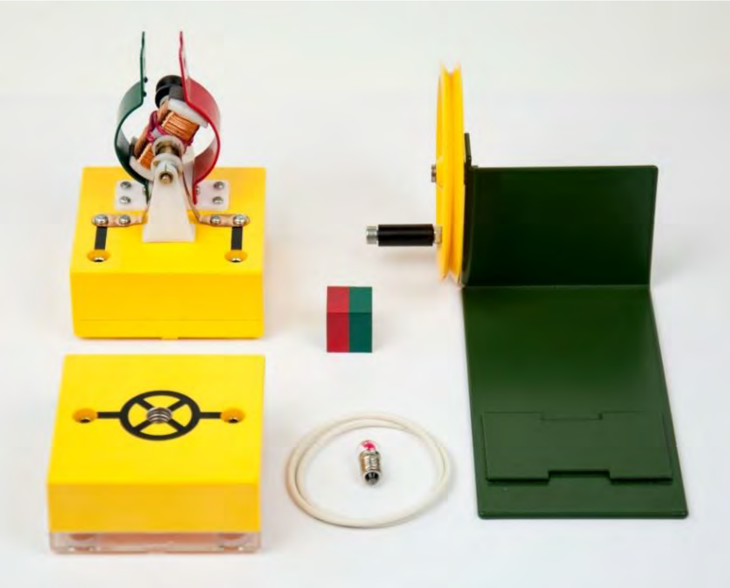
Required Kits:
P9901-4D Electricity 1
P9902-5T Electrodynamics

Material:

Item Code	Qty	Description
P3806-1M	1	Motor - Generator model "compact"
P3310-2E	2	Connecting lead SE, 25 cm, black
P3910-1A	1	Plug-in panel, small
P3910-1B	2	PIB connector
P3910-2A	1	PIB lamp socket E 10
P3320-1A	1	Light bulb, 2.5 V/70 mA (1.5 V/50 mA), E10

Additionally required:

	1	Measuring device
	1	Power supply



DC GENERATOR –
EXTERNAL POLE GENERATOR

EMS 4.4

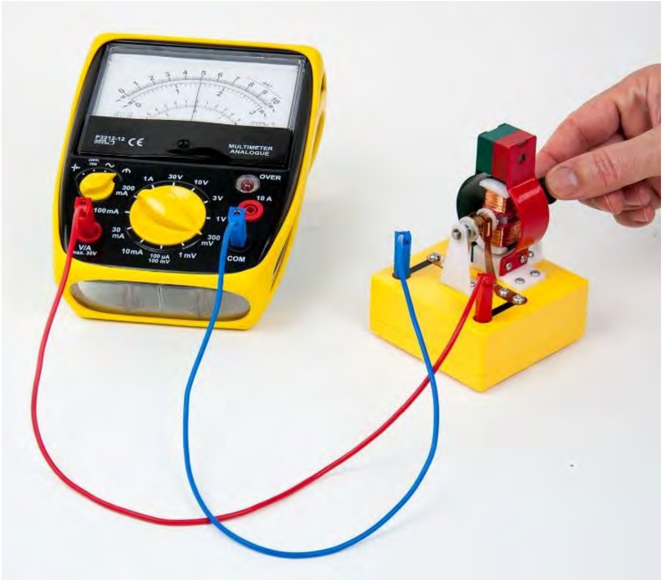
Experimental target:

Become acquainted with a generator of which the external magnetic field (external magnet poles) is constant

Setup:

The set-up is exactly the same as for the DC motor.

However, we connect the connection sockets of the motor to an analogue measuring device. The range of 300 mV DC is set on the measuring device. We select the pointer centre position.



1. Experiment:

With the fingers we make slow half-turns of the rotor via the drive shaft. Several half-turns should be made in succession. While doing this, we observe the pointer deflection.

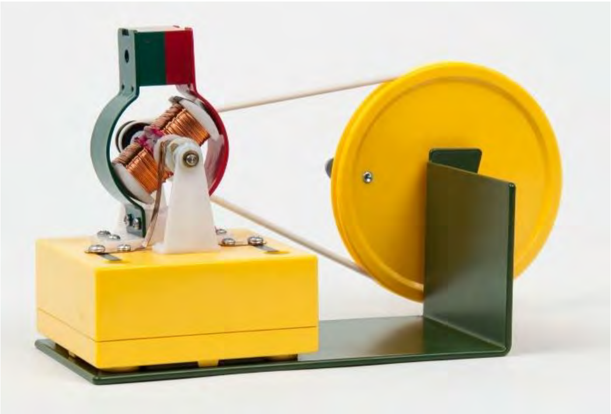
Now we change the direction of rotation and observe the pointer deflection again.

Conclusion:

As soon as the rotor is moved, voltage is induced in it
by the external magnetic field.
Changing the direction of rotation causes the polarity of the induced voltage to change.

2. Experiment:

The motor is now placed on the base plate of the drive unit. The crank and the drive shaft are connected to the belt.



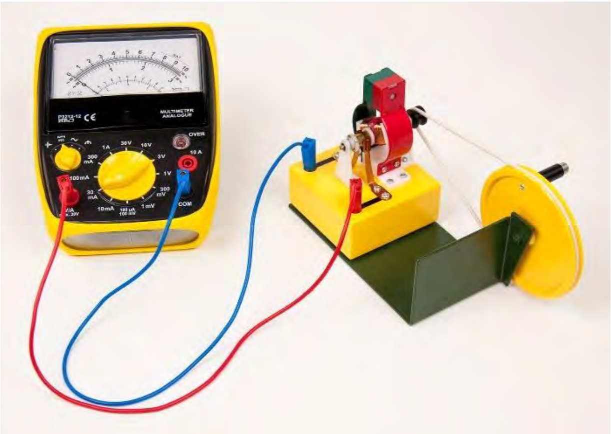
The range of 1 V DC is set on the meter.
We select the pointer-left position.

We now try to turn the crank as slowly as possible and observe the pointer deflection on the meter.

Then we crank faster and faster.

What does the meter show?

Where does the voltage come from, that is displayed on the meter?



Conclusion:

With a slow rotation we see that there is a "pulsating" voltage.

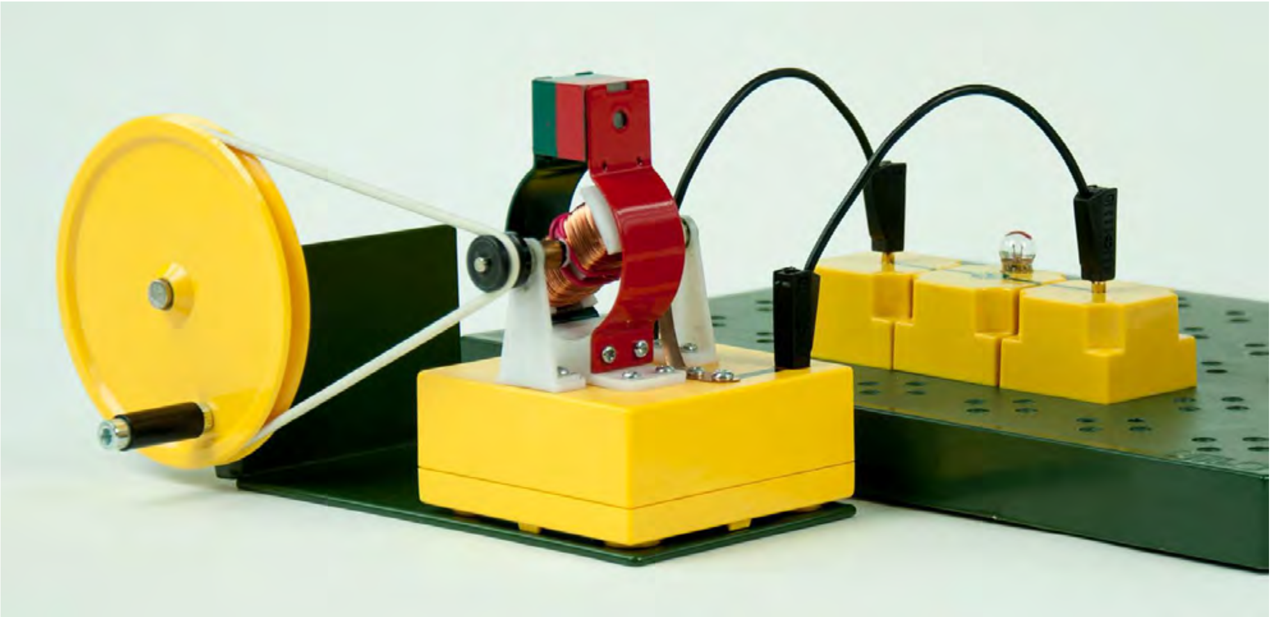
A faster rotation causes a higher voltage. The pulsating voltage can be recognised by the "trembling" of the pointer.

Note:
Strongly pulsating voltages can cause analogue measuring instruments to swing into the minus range.
It is therefore advisable to use a digital measuring device for this experiment.

DC GENERATOR –
EXTERNAL POLE GENERATOR

EMS 4.4

3. Experiment:



A PIB lamp socket with two PIB connectors is plugged onto the plug-in panel.
A 2.5V/70 mA lamp is screwed into the socket.

The lamp is connected to the generator with two connecting leads.

By moving the crank quickly, we try to make the little lamp glow.

DC GENERATOR – EXTERNAL POLE GENERATOR

EMS 4.4

Further experimental options:

The block magnet can be replaced by the electromagnet. If this is supplied with voltage, other types of generators can be shown.

By connecting two motor/generators with the belt as shown in the figure below, the energy transfer can be demonstrated on two systems.