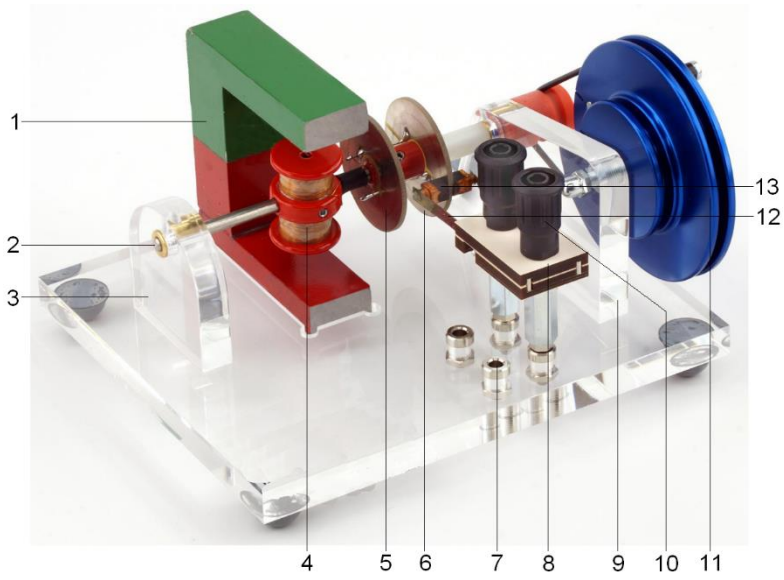
Electromotor and Generator, Complete 1017801

Instruction manual

01/14 TL/ALF



1 Magnet
2 Armature shaft
3 Left-hand bearing support
4 Armature coil
5 Slip ring
6 Commutator
7 Attachment for current collectors (left: AC, right: DC)
8 Current collectors
9 Right-hand bearing support
10 Connector sockets for current collectors
11 Drive pulley / hand crank
12 Leaf springs for current collectors
13 Carbon brushes

1. Safety instructions

The magnet is not attached to the base plate but remains loose, so there is a risk of it falling.

Caution: Certain unauthorised operating conditions (excess voltage, supply of current when stationary) could cause the armature winding to get hot.

- Stay within the permitted operating parameters.

2. Description

The equipment is a working model to demonstrate the basic operating principle of electric motors and generators. The simple and easily understood design closely mirrors the fundamental principle. The commutator, slip rings for AC operation and the armature coil are all located on the armature shaft.

The commutator and current collectors change the polarity of the armature coil after each half turn of the armature shaft. As the armature coil passes through a vertical position aligned along the magnetic field, the polarity of the coil changes in such a way that its north pole N is adjacent to the north pole of the magnet and its south pole is opposite the magnet's south. The momentum of the coil causes it to move past this point and the repulsive force of the like poles then exert a torque on the coil. Once the armature coil moves past the horizontal position, attractive forces between the magnet and the rotor then become increasingly dominant.

When set up as a DC generator, the model outputs a sinusoidal half-wave signal (pulsating DC). The polarity depends on the position of the magnet and the direction of rotation.

When set up as an AC generator (current collectors reconnected on to the slip ring), it is possible to obtain an output close to a sinusoidal voltage.

3. Technical data

Operating modes:	DC motor, DC and AC generators
Nominal voltage of motor:	9 V
No-load voltage In generator mode	2.5 V
Base plate:	130 x 150 mm²
Weight including magnet	0.85kg approx.

4. Additionally required equipment

1 ESCOLA 10 multimeter	1006810
or	
1 USB oscilloscope 2x50 MHz	1017264
1 DC power supply, 20 V, 5 A (@115 V)	1003311
or	
1 DC power supply, 20 V, 5 A (@230 V)	1003312
Experiment leads	

5. Operation

- Place the horseshoe magnet on the base plate in such a way that the armature coil is between its two poles.
- Attach the yoke to the back of the magnet in order to reduce the magnetic field.

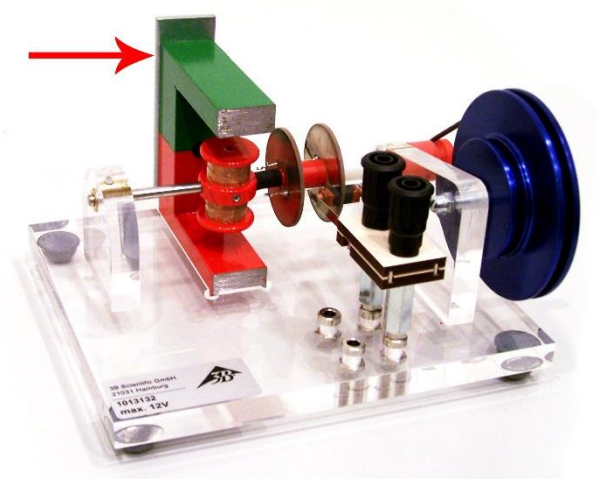


Fig. 1 Horseshoe magnet with yoke

5.1 Configuration as DC motor

- Insert the current collectors into the right-hand pair of sockets of the terminal panel on the base plate (see Fig. 2).
- Spread out the carbon brushes slightly and guide them over the disc.
- Push the current collectors onto the base plate as far as they will go (without bending the carbon brushes).
- Take the drive ring off the drive pulley (for easy starting).
- Plug the power supply into the sockets.
- Supply the motor with no more than 12 V.

It is necessary to give the rotor a push to get it started from its initial position (armature coil vertical).

No voltage may be applied to the motor while it is stationary (start the motor turning first).

5.2 Configuration as generator

- Thread the drive ring over the armature shaft and drive pulley and use the crank to turn the armature shaft.
- Connect the multimeter to the connector sockets. Observe how far the needle moves.

5.2.1 DC generator

- Insert the current collectors into the right-hand pair of sockets of the terminal panel on the base plate (see Fig. 3).

It is possible to tap a DC (pulsating DC) voltage across the commutator (see Fig. 4).

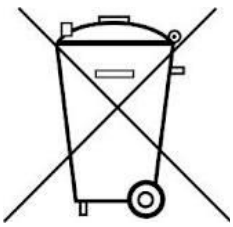
5.2.1 AC generator

- Insert the current collectors into the left-hand pair of sockets of the terminal panel on the base plate (see Fig. 5).

It is possible to tap an AC voltage closely resembling a sine wave across the slip ring (see Fig. 6).

6. Storage, cleaning, disposal

- Keep the equipment in a clean, dry and dust free place.
- Do not clean the unit with volatile solvents or abrasive cleaners.
- Use a soft, damp cloth to clean it.
- The packaging should be disposed of at local recycling points.
- Should you need to dispose of the equipment itself, never throw it away in normal domestic waste. Local regulations for the disposal of electrical equipment will apply.



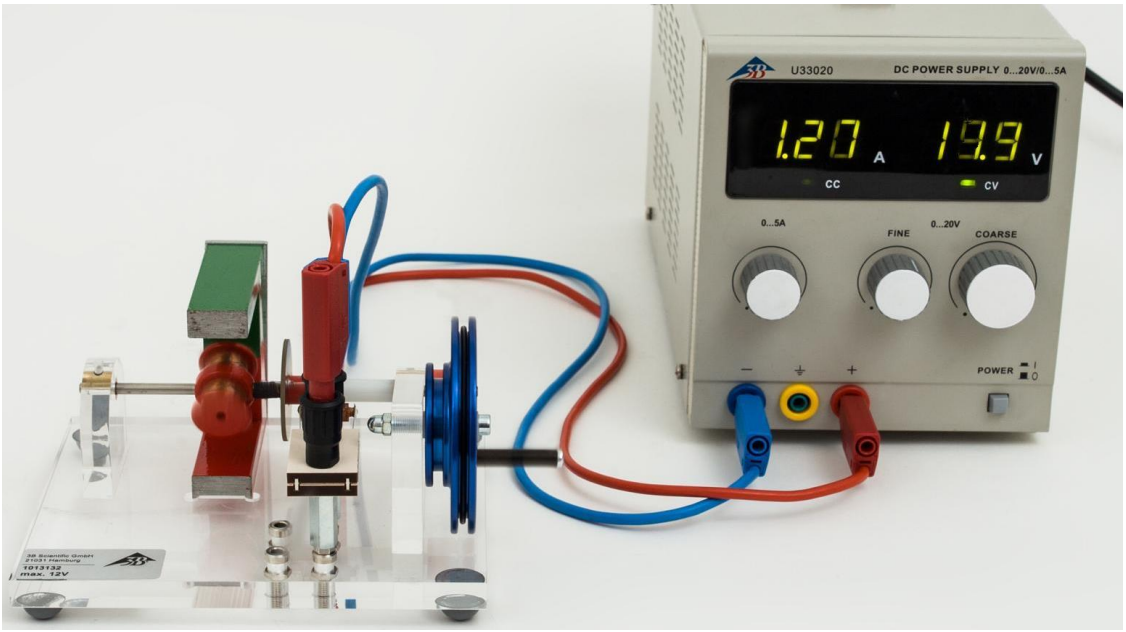


Fig. 2 Operation as a DC motor

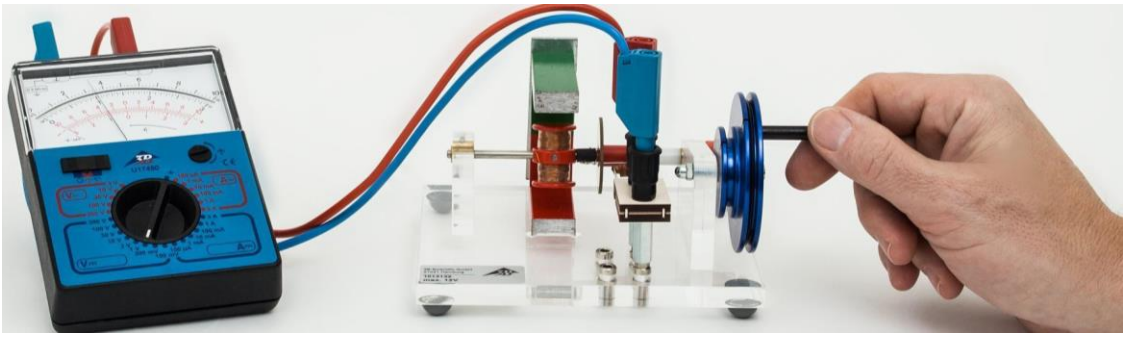


Fig. 3 Operation as a DC motor with ESCOLA 10 multimeter

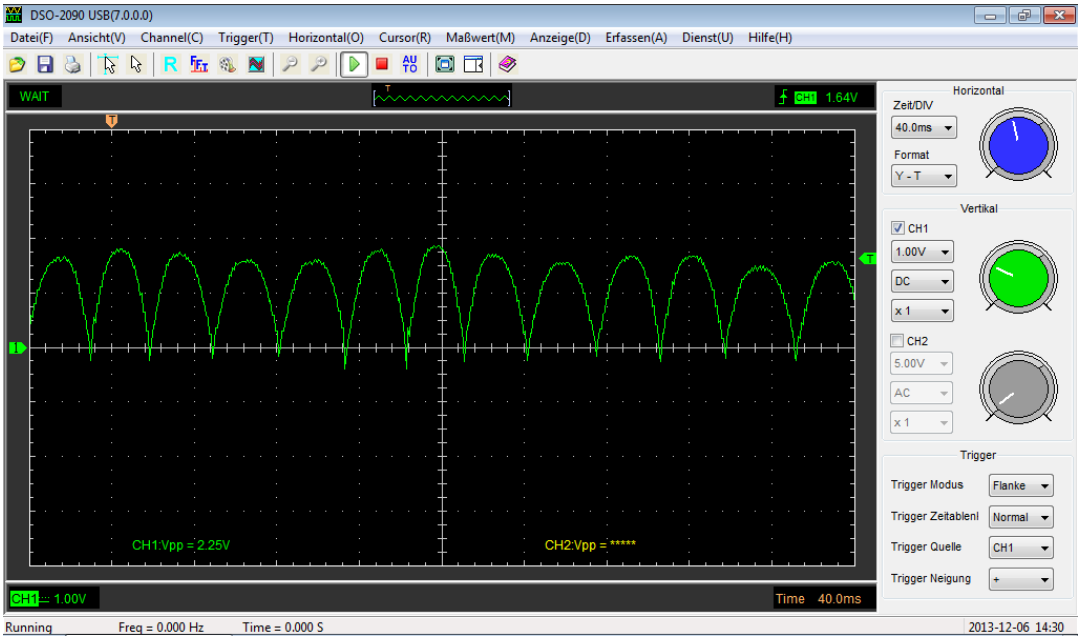


Fig. 4 Display of a (pulsating) DC voltage on a USB oscilloscope

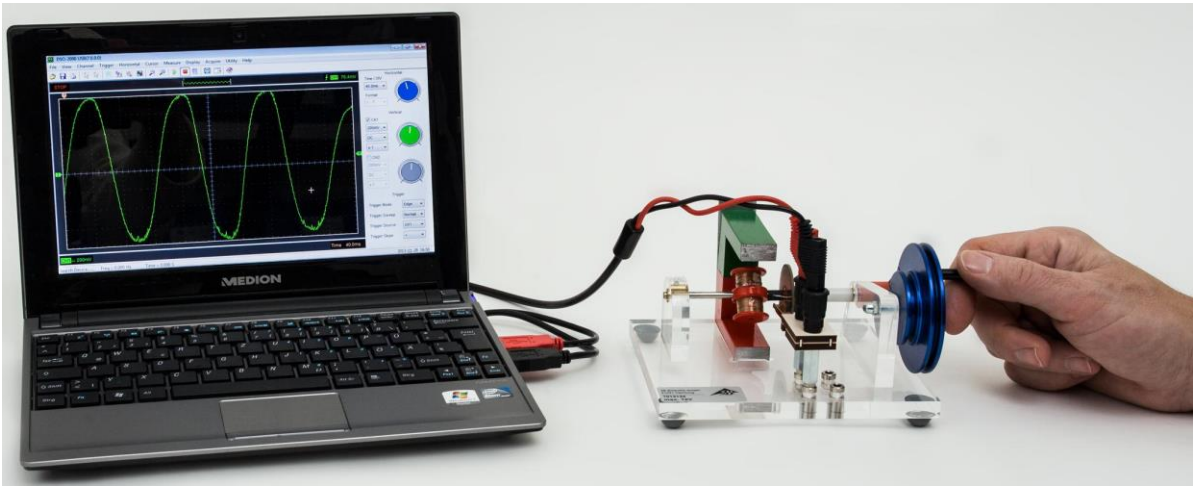


Fig. 5 Operation as an AC generator with a USB oscilloscope

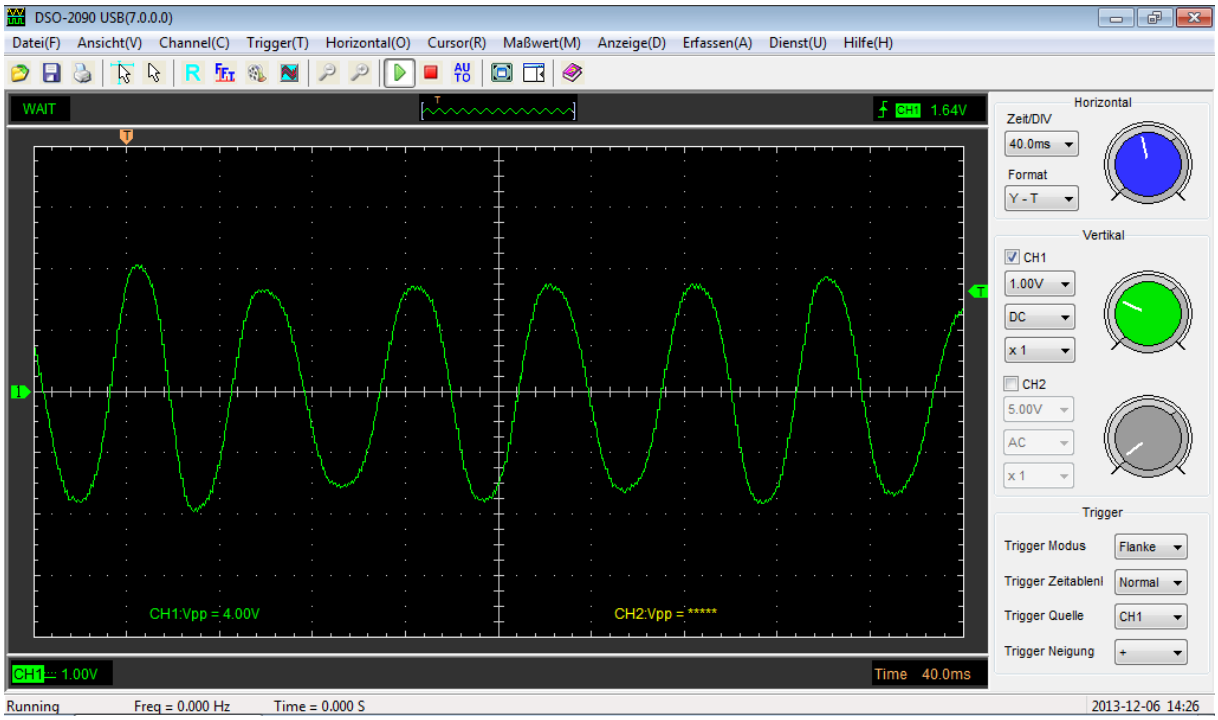


Fig. 6 Display of an AC voltage on a USB oscilloscope