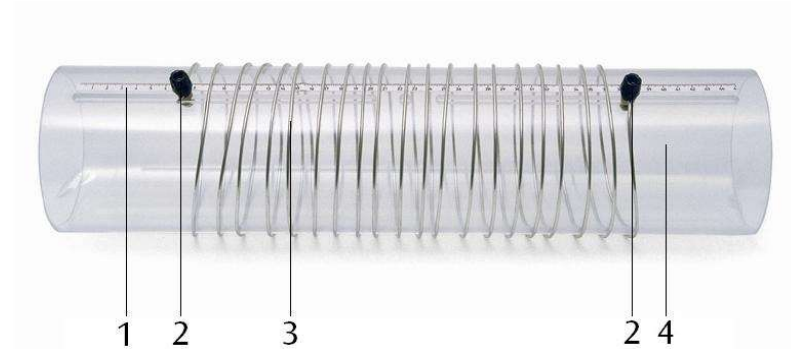


Coil with Variable Number of Turns per Unit Length 1000965

Instruction Sheet

10/23 ALF/UD



- 1 Scale
- 2 4mm safety sockets
- 3 Coil wire
- 4 Coil bobbin

1. Safety instructions

- Operation of the coil is only allowed with extra low voltages.
- Do not exceed the maximum current for long-term use.
- Do not touch the coil during the experiment.
- If the coil should become overloaded, they must be allowed to cool before switching on the current again.
- Any modifications to the set-up must be made with the primary voltage switched off.

2. Description

The coil of variable number of turns per unit length is used to investigate the magnetic flux density in cylindrical coils as a function of the number of turns per unit length.

The coil has a cylindrical bobbin made from acrylic glass with adjustable 4 mm safety sockets. By means of a clamping device the distance between the ends of the coil windings can be mechanically locked. A cm scale allows easy reading of the coil length. The current may exceed the indicated long-term maximum for short periods.

3. Technical data

Coil diameter:	100 mm
Number of turns:	30
Coil length:	490 mm
Max. Current:	10 A, for short periods 20 A
Anschluss:	4 mm safety sockets

4. Operating principle

Inside a coil the magnetic flux density B depends on the number of turns n , the coil length L and the coil current I . For an air-core coil it is given by the equation:

$$B = \mu_0 \cdot n \cdot I \cdot \frac{1}{L} = \mu_0 \cdot I \cdot \frac{n}{L} \quad (1)$$

The magnetic field constant is

$$\mu_0 = 1,256637 \cdot 10^6 \text{ Vs/Am.}$$

5. Sample experiments

For the experiment the following additional devices are required:

1 Stand for Cylindrical Coils	1000964
1 Teslameter N (230 V, 50/60 Hz)	1021669
or	
1 Teslameter N (115 V, 50/60 Hz)	1021671
1 DC Power Supply, 32 V, 20 A (230 V, 50/60 Hz)	1012857
or	
1 DC Power Supply 0 - 16 V, 0 - 20 A	1002771
1 Set of 15 Experiment Leads, 75 cm 2.5 mm ²	1002841
1 Barrel Foot, 1 kg	1002834
1 Stainless Steel Rod 250 mm	1002933
1 Universal Clamp	1002830
1 Universal Jaw Clamp	1002833

5.1 Confirmation of equation 1

- Put the coil on the stand and connect it to the power supply unit.
- Switch on the power supply unit and adjust the current to approx. 10 A.
- Measure the magnetic flux density B with the magnetic field sensor.
- Determine the length of the coil and use equation (1) to calculate the theoretical value for B .
- Repeat the measurement with different coil lengths.
- Compare the calculated values with the measured ones.

5.2 Determination of the magnetic field constant μ_0

- Measure the magnetic flux density B with different coil lengths l .
- Record the values in a table and plot B as a function of $1/L$ in a coordinate plane.

The slope m corresponds to the product $\mu_0 \cdot \frac{n}{L}$.

Hence

$$\mu_0 = \frac{m \cdot L}{n} \quad (2)$$



Fig. 1: Measurement set-up