Application Note PE010

Bar magnet

At the surface, the exit flux density is measured. The larger the distance of the probe to the exit surface, the lower the measured value!
The output flux density can be measured both by laying a transversal probe flat (see on the right in the picture) and by placing an axial probe vertically (see left in the picture). Turning the transversal probe (180 °) does not produce exactly the same value, since the active surface of the Hall element is not in the center plane of the probe.

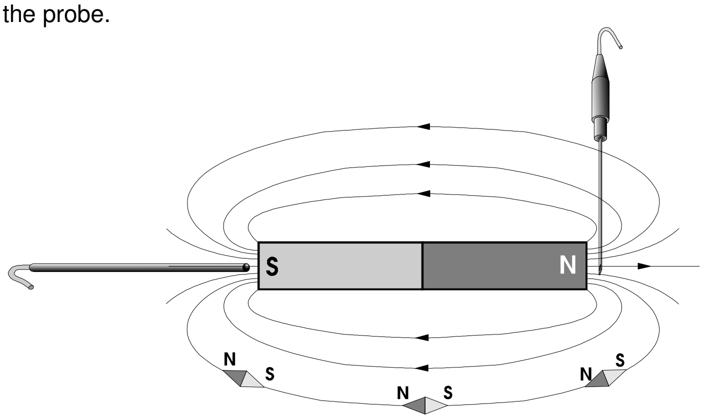

Figure 1: Bar magnet

Cylindrical inductor

The field inside a cylindrical coil can only be measured with an axial probe. If you introduce the probe into the coil, the field lines lie lengthwise to the probe. With the axial probe, this is also the measuring direction. In the case of the transversal probe, the field lines are perpendicular to the measuring direction, so that no usable measuring signal can occur. As with the bar magnet, however, the exit flux density can be measured with both types of probes.

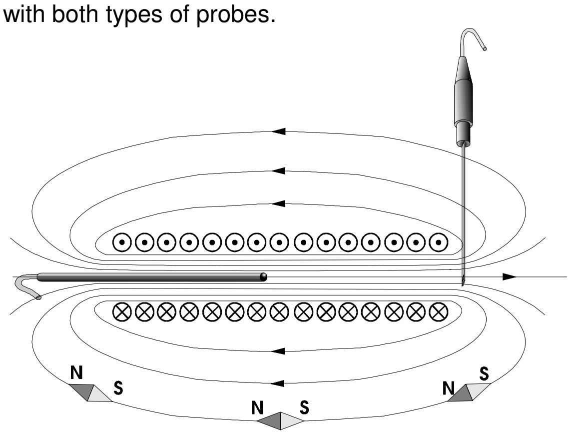

Figure 2: Cylindrical inductor

Electromagnet

The narrow air gap of an electromagnet is traversed perpendicularly by the magnetic field. Here, the transversal probe is ideal for measuring. In particular, the very thin probes are advantageous in this case if measurements are to be carried out in very small air gaps.

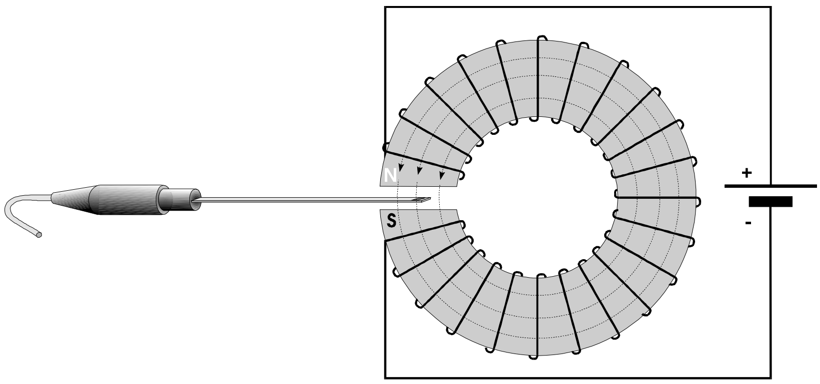

Figure 3: Electromagnet

Field of a leader

Each conductor through which electricity flows builds up a magnetic field according to the "right-hand rule", which surrounds the conductor concentrically and weakens with increasing distance. The transversal probe is aligned perpendicular to the conductor during the measurement!

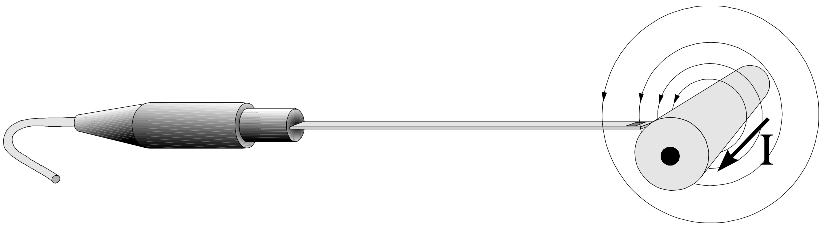

Figure 4: Field of a leader

If you are exactly under the line, the value can be determined by holding the axial probe horizontally (across the conductor).

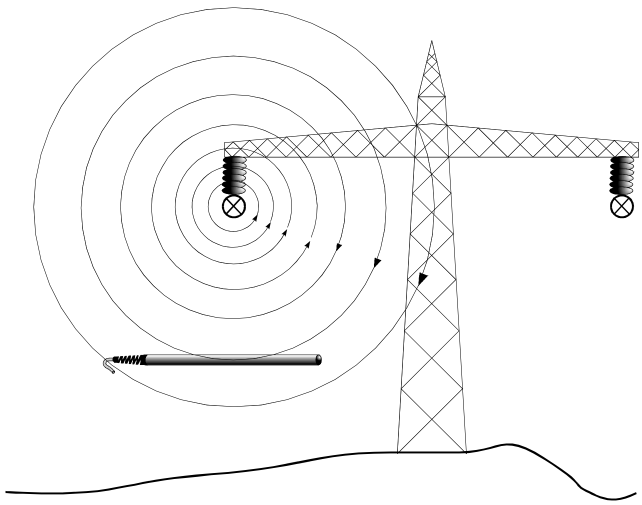

Figure 5: Field of a single high voltage line

Field of two ladders

If two conductors are traversed by a current, the superposition of the individual magnetic fields results in a total field. The appearance of this total field depends on the current direction and the current in the individual conductors. The picture shows the magnetic lines of force around two parallel conductors, through which equally strong, rectified currents flow.

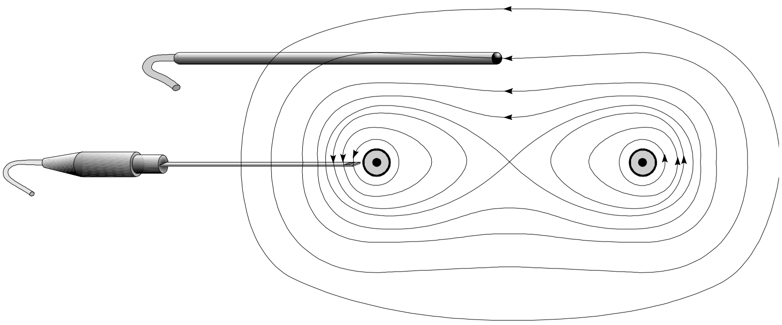

Figure 6: Field with two conductors (rectified currents)

If the current flows in the opposite direction through two parallel conductors, the following picture results for the magnetic field:

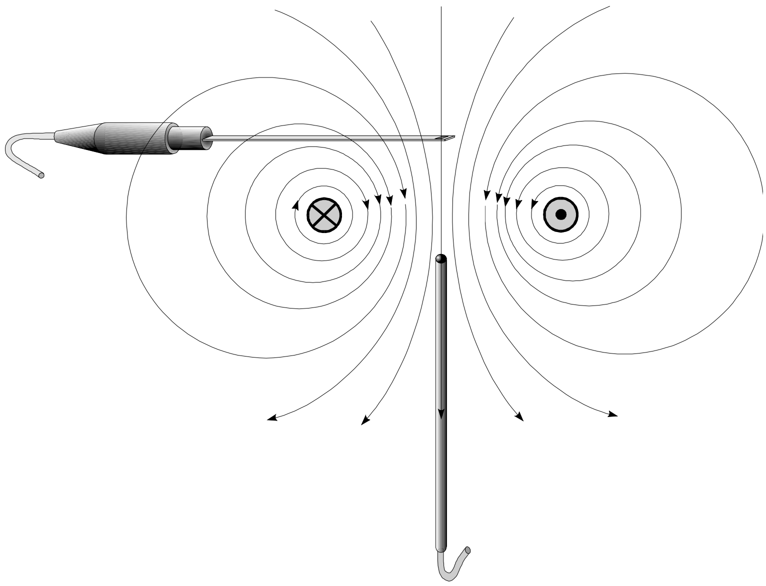

Figure 7: Field with two conductors (opposing currents)

Holding magnet disc

In order to measure the flux density on the surface of a magnetoresistive disk, it is again possible to use both a flat transverse probe and a perpendicular axial probe.

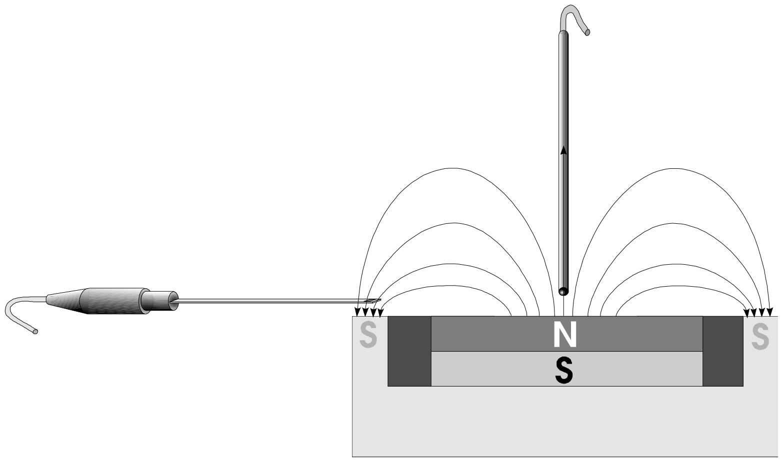

Figure 8: Holding magnet disc

Speaker pot magnet

In order to measure the field in the air gap of a loudspeaker pot magnet, only the transversal probe is suitable, as here the field is again perpendicular to the air gap and thus also to the measuring probe. This corresponds exactly to the measuring direction of the transverse probe. With the thin probe, even narrow air gaps can be measured.

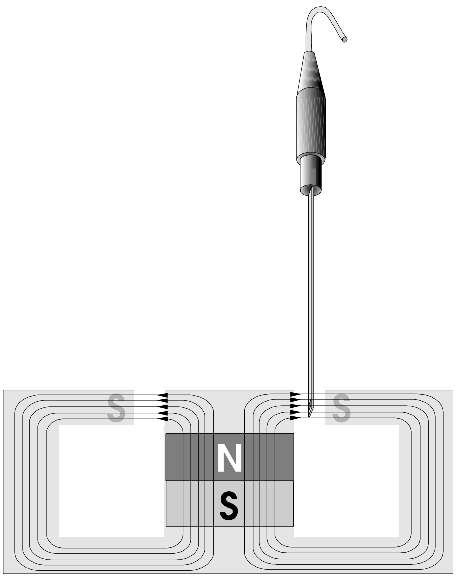

Figure 9: Speaker pot magnet

Field of a (road) railway

The overhead lines of railway systems are current-carrying conductors, which builds up a magnetic field according to the "right-hand rule". Due to the driving movements, the current flow and thus also the magnetic field are not constant over time. In addition, it comes with railway systems to AC with 16⅔ Hz, so it creates an alternating field of this frequency. This magnetic field can generate disturbances, e.g. lead to dynamic color distortions on computer monitors. Computer tomographs, electron microscopes and similar devices that are sensitive to the slightest changes in the magnetic field can be significantly disturbed in their function.

With our Teslameter FM 205 with UAP probe, you can measure such disturbances ranging from approx. 100 nT up to several µT and check the effectiveness of shielding measures.

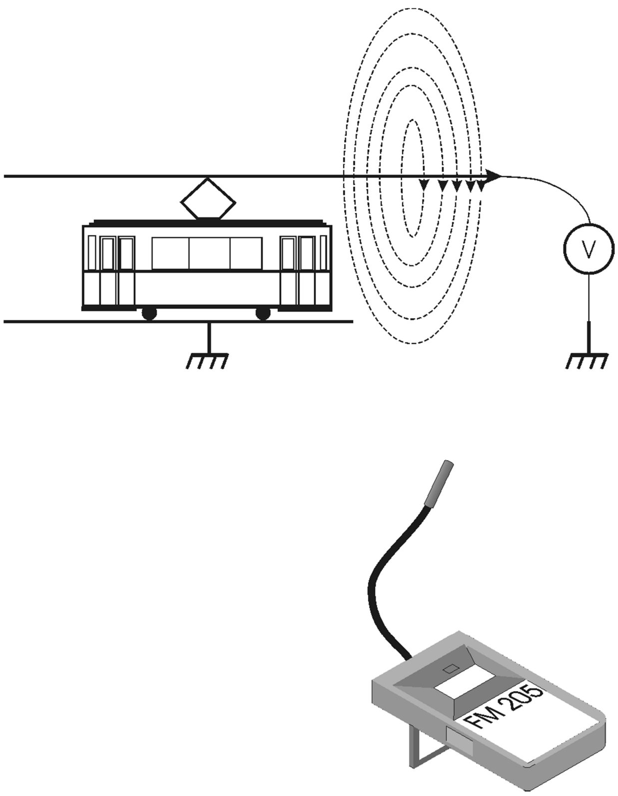

Figure 10: Field measurement of a (road) railway

The teslameters have an analogue output, which not only allows measurement of the disturbances. With a suitable coil system and a control amplifier, you can even compensate the interference fields for defined smaller volumes.

Compensation of the Earth's magnetic field

In the case of highly accurate magnetic measuring stands or electron microscopes, the influence of the earth's magnetic field is disturbing. With the help of compensation coils, the earth's magnetic field can be compensated. With the coils, a magnetic field opposing the earth's magnetic field is built up. The coils are regulated via the analog output of the FM 205 basic unit.

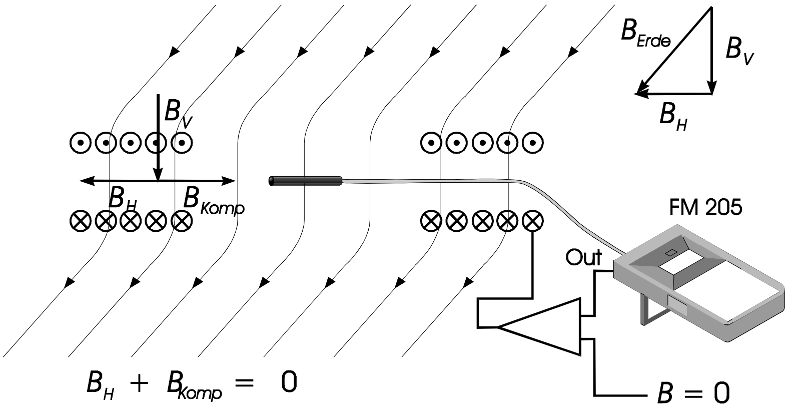

Figure 11: Compensation of the Earth's magnetic field

Regulation of an electromagnet

With the Teslameter FM 205, the flux density can be measured in an electromagnet. For higher precision requirements, the Teslameter FM 3002 is suitable in conjunction with a transversal probe. With this magnetic field meter, the course between the pole shoes can be determined very accurately.

Due to their analog output, all listed Tesla meters are suitable for controlling the flux density in the air gap with appropriate controllers. There is a faster and more stable setting compared to a current control

Also in superconducting magnets, e.g. in magnetic resonance imaging, the flux density can be measured. Particularly suitable here is the FM 205 with its high-field probe flux densities up to 12 T can be measured.

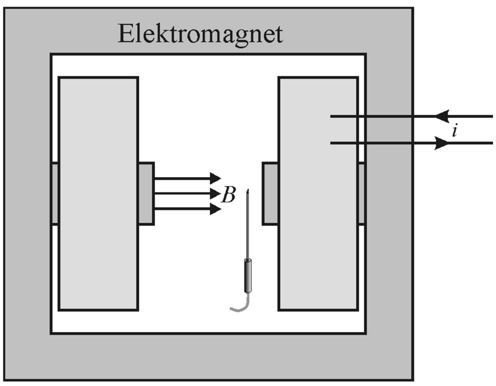

Figure 12: Electromagnet with probe for field control

Other applications

Aligning monitors
To minimize distortion, high-resolution CAD monitors should be aligned with the Earth's magnetic field.

Measurement of alternating stray fields
The Teslameter FM 205 with UAP probe can also accurately detect 50 Hz stray fields from transformers or similar magnetic field generating loads.

For measurements to comply with the IATA 902, which requires a magnetic field of <0.525 µT at a distance of 4.6 m for airfreight, the UAP probe is suitable, with its measuring ranges of 2 µT, 20 µT, 200 µT up to the nanotesla range can.

Aligning high-precision magnets and medical magnetic fields

Measurements in the school, university and experimental area