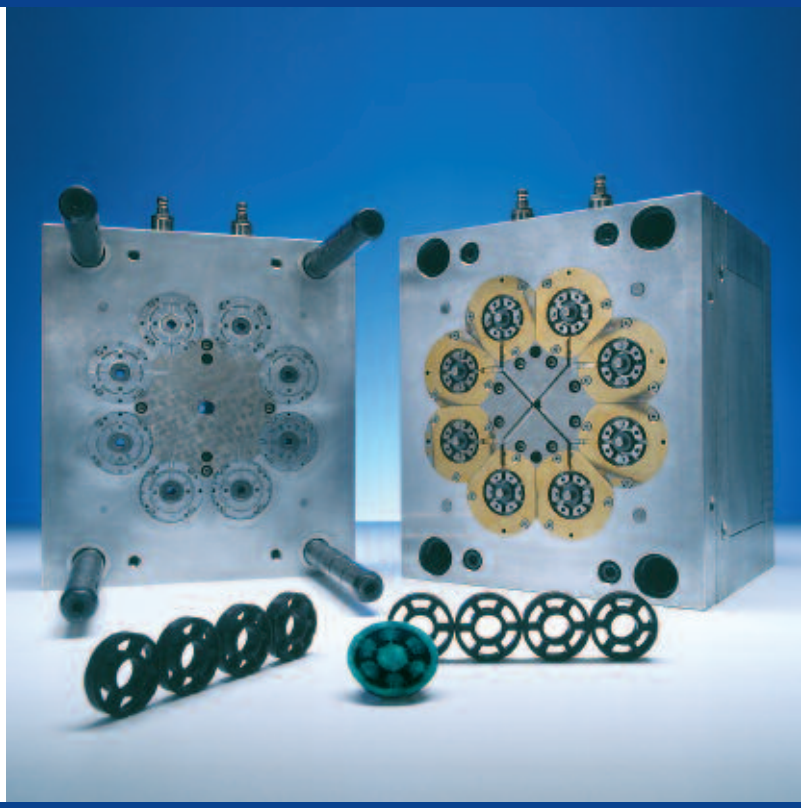
magnetfabrik bonn

Polymer Bonded Permanent Magnets for Sensors



Magnets from Bonn: the safe way to cost-effective solutions

Magnetfabrik Bonn is your partner in magnet sensor technology, as we can call upon more than 70 years of development and manufacturing experience and also upon the know-how from thousands of applications in the field of permanent magnets. We use this competence to offer customized solutions, which give you a decisive competitive advantage.

Polymer bonded magnets for sensors

The significant progress during the last years in the development of nanotechnology has meant that the technology of magnetism-based sensors has penetrated more and more fields of application. Especially in the machine tool and automotive industries, the demand is growing for non-contact and non-wear switching systems and also for systems for measuring a wide range of physical parameters. As a specialist for permanent magnet materials, Magnetfabrik Bonn has become one of the leading suppliers of magnets for sensor technology in the international market.
Our comprehensive range of materials along with our extensive production and application know-how enable us to supply you with cost-effective products to suit your individual requirements.

Significant advantages for the customer:

1. An uncompromising zero-defect philosophy
2. Our specialization in precision magnets satisfying the highest mechanical and magnetic requirements
3. Long production runs, as required in the automotive industry
4. Up to date logistics
5. Cost-effective production via a high degree of automation

Typical applications of modern sensor technology in the automotive industry

• ABS systems • ESP • Steering angle sensors • Fuel tank level sensing • Position sensing for valve control
• Locking systems • Tachometers • Automatic gear control • Power window control • Sun roof control
• Seat belt lock sensing • Load leveling systems • X-by-wire

Magnets from Bonn: competence in sensor technology

The rising demand for convenience, safety and quality in many industrial sectors requires precise sensor technology suiting individual applications and products, with a very high reliability and thermal stability. A wide range of types of sensor is in use – developed for various different tasks, working surroundings and cost considerations.

The application determines the type of sensor

Hall sensors

Hall sensors utilize the influence of a magnetic field on an electric current. As a result of the Hall effect, the magnetic field strength can be measured in one direction. Because of their low voltage, Hall ICs are frequently configured with integrated amplification and signal interpretation. Analog sensors provide an output voltage that is almost linearly proportional to the magnetic field (within a specified field strength range). As an alternative there are a great number of digital output sensors, which only react to either the north or the south pole (unipolar sensors) or to both poles (bipolar sensors).
An occasionally wide distribution of the switching values must be considered – as must also be the dependence on temperature and the hysteresis between switching on and switching off points.

Magneto-resistive sensors

Based on the change in electrical resistance of a conductor in a magnetic field, these sensors provide an analog voltage signal too. However, because of the poor linearity, the applications based on the classical magneto-resistive effect together with permanent magnets are restricted.

Equipment for measuring magnetic field patterns

AMR sensors

AMR sensors utilize the anisotropic magneto-resistive effect, i.e. they exploit the difference between resistivity parallel to and that perpendicular to the magnetization in magnetic materials. These sensors have found new applications as angle sensors during the last years in magnet technology, as an angle sensor can be manufactured in a simple way on one chip from two sensors.

Reed switches

Hermetically sealed (in an inert atmosphere) in a glass tube, two ferro-magnetic reed blades come into contact when exposed to a magnetic field.

Magnetfabrik Bonn: specialist for polymer bonded magnetic materials

Sensors impose stringent requirements on the precision and repeatability of the magnetic fields concerned. Polymer bonded magnetic materials, for which a magnetizable filler is bonded in a plastic matrix, fulfill all these requirements in an ideal way. They have the advantage of a high magnetic and mechanical homogeneity at moderate magnetism levels. Thanks to a production process which is cost-effective and capable of a high degree of automation, our magnets can be produced particularly efficiently and economically.

To meet our customers' specific needs we offer a wide range of materials, from low cost ferrites to magnetic stronger rare earth materials, in combination with various binding materials and production processes. Please feel free to ask for our up-to-date overview of materials.

When designing sensor magnets, some basic rules have to be considered:

❶ The influence of temperature

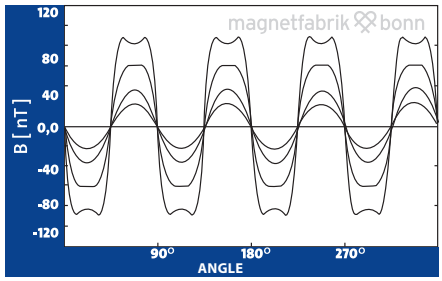
If the surrounding temperature is increased, the magnetic field of a permanent magnet decreases, reversibly, almost linearly over a wide range of temperatures. However, at extremely high temperatures, irreversible losses in magnetism occur and these become more and more marked with increase in temperature. The losses depend significantly on the material, the temperature and the form of the magnets, whereas the duration of the exposure plays a less significant role.

❷ Field strength of multipolar magnets

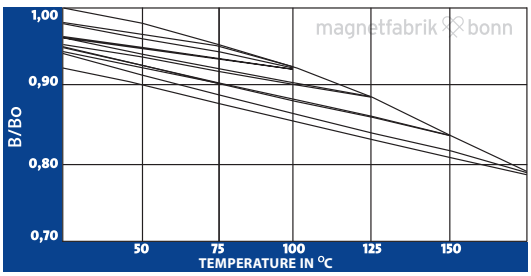
The magnetic parameters of materials are only indirectly related to the magnetic field that exists at the location of the sensor. Depending on the type of magnetization and the form of the magnets, the magnetic flux density at the pole surface of a magnet amounts to an order of magnitude of 80 - 120 mT, given a remanence of say 220 mT. With increasing distance, the closer the poles are in a multipolar magnet, the higher the rate of decrease of magnetic flux density.
When specifying the required field strength, it should always be borne in mind that distance relates to the sensitive element within the chip housing (the so-called active surface), and not to the outer surface of the chip housing.

The change of polarity corresponds to changes in field strength. Close to the surface of the magnet the field strength changes abruptly as the polarity changes, whereas with increasing distance the variation in field strength is represented very closely by a sinus curve.

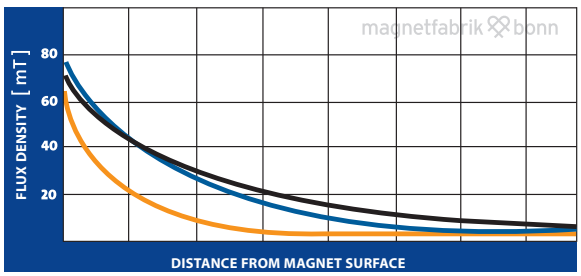
Variation in field strength for eight poles with a distance from the magnet surface of 0.5 to 3.5 mm



Irreversible losses for Neofer 44/60p, L/D ~ 0.85



Multipolar magnetized sensor rings from Sprox 11/21 p, outside diameter 12 mm.



Developing, improving, integrating – because quality has the highest priority

The comprehensive range of products and services of Magnetfabrik Bonn is the main reason for operating successfully in widely differing market segments. Our production processes for polymer bonded permanent magnets are just as versatile as the applications of our magnets and the range of materials chosen for these applications. We have perfected these processes over a great number of years.

Our research, development and engineering design functions are all under one roof. We use this concentration of resources to solve the most demanding problems in an intensive dialogue with our customers, in which both individual applications and requirements on the sensor magnets are specified. These specifications are then the basis for us to deliver tailor-made and cost-effective solutions to our customers.

Our quality management according to DIN EN ISO 9001: 2000 and ISO/TS 16949: 2002 bears witness to our determination to achieve continuous improvement.

TÜV CERT
DIN EN ISO 9001:2000
ISO/TS 16949:2002
Zertifikat: 01 111 70013

When making an inquiry please answer following questions. This will help us to use our expertise to offer you the best solution.

- As far as already specified, which sensor is intended for use?
- What are the required dimensions of the sensor magnets?
- To which temperatures will the sensor magnets be exposed?
- Are there any iron objects, permanent magnet or electromagnetic fields in the vicinity of the sensor magnets?
- How would you describe the surroundings of the magnet (damp, aggressive, normal)?
- At what flux density should the sensor be activated?
- How large is the distance between the sensor and the magnet?
- How exactly should the switching position be specified?
- What is the distance of the sensor's outer surface to its active surface?
- Will the sensor magnet be inserted, or sprayed over, or clamped, or affixed?
- Is the magnet subjected to a mechanical load (pressure, rotation)?
- What is the probable quantity required?
- Is a fully automated further processing intended?
- A detailed description of the application – if possible, accompanied by a sketch.

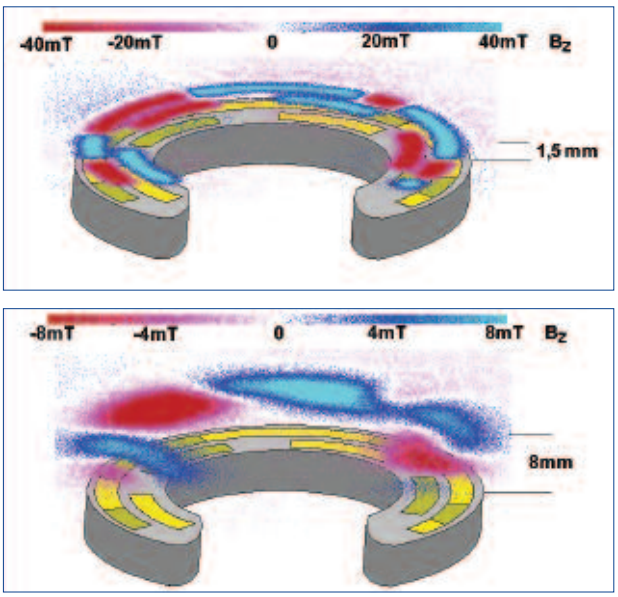
Magnetfabrik Bonn: partner of the automotive industry

In many applications, a multipolar ring magnetized on the circumference or the frontal side is interrogated using a digital Hall sensor. If the absolute value of the angle at which the sensor is activated needs to be specified as exactly as possible, the tolerance of the sensor switching point and the temperature drift of the magnet requires the slope of the magnetic field with respect to the angle being as steep as possible. In such cases it makes sense to dimension the magnet in such a way, that the magnetic field has a significantly higher value than the required switching limit. The slope can also be favorably influenced by a corresponding dimensioning of the magnetizing and injection tools (trapezoidal curve).

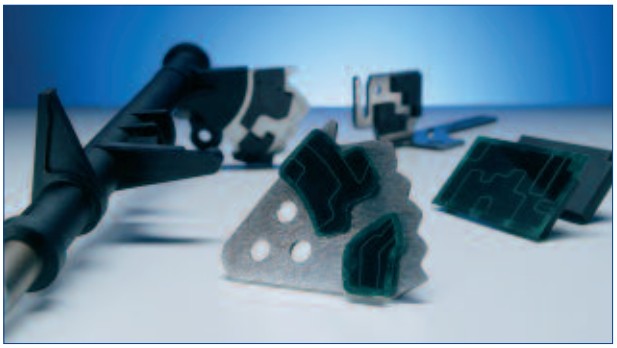
The following examples show products and systems we have developed for various customers.

Multi-channel interrogation of a gear shifting gate

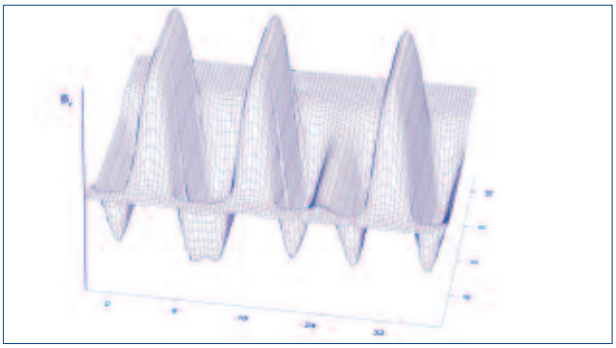
In locking systems or gearboxes for the automotive industry, several digital switches are activated at varying switching positions. In these applications the switching functions are realized by means of several channels on a magnet, of which the north and south poles serve as the on and off positions of the switch. Basically, a switching point is identical with the change in polarity only directly at the magnet's surface, whereas at a distance of more than 1 mm the magnetic fields of the various channels influence each other. By using a procedure for calculating the field, the magnetization can be so optimized, that the switching positions correspond to the required positions.



Pole representation with increasing distance from the magnet's surface



Lever slide

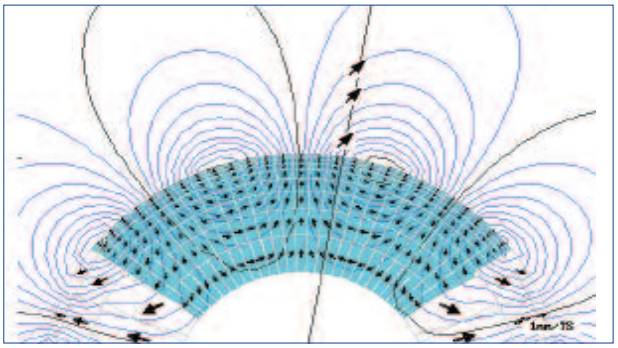


Magnetic field pattern

Magnetfabrik Bonn: competence in magnetism for well-designed sensor solutions

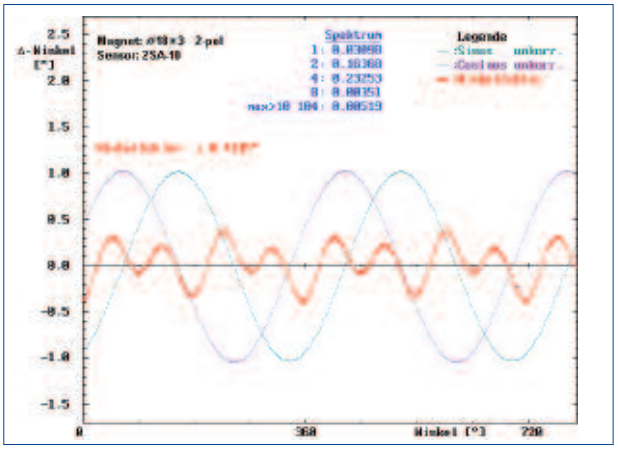
Static angle detection using an AMR sensor

The angle of the magnetic field reacts much less sensitively than field strength to changes in the distance of the sensor from the magnet surface. With AMR sensors or with multiple hall sensors, an angle signal can be processed.



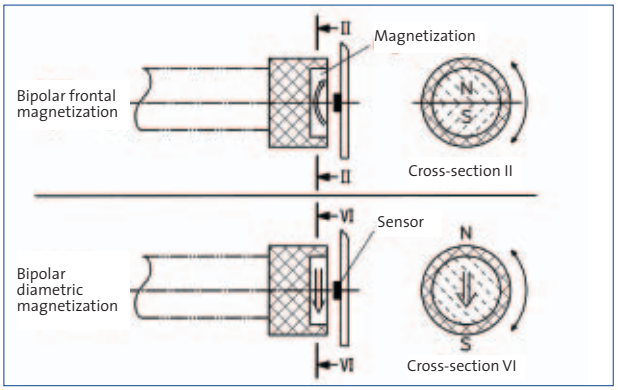
Stable field angle at variable distance between magnet and sensor

Angle detection is an analog measurement process, i.e. stringent requirements are made on the homogeneity of the angle and the accuracy of magnetization.



Measured angle error

A typical procedure consists in interrogating an AMR element frontally by means of a bipolar magnetizing agent, magnetized at the surface. The type of magnetization can be specified so that the homogeneity is significantly less than 1 degree of arc over a diameter range of several mm. In this order of magnitude, stringent requirements are made on the magnetization and measurement technology. With specialized measuring instruments it is possible to record angle variations in a cost-effective way during the production, on the basis of large samples.



Direction of magnetization for angle detection

See what we can do

Providing solutions for our customers' challenging requirements has always been a central part of our work at Magnetfabrik Bonn. We deliver the goods – using our experience, specific know-how, strong commitment, individual advice and trouble-free project management. See what we can do. Contact us. It will be well worth your while.

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