Application Note PE013

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1 Selection

For the selection of the right teslameter, we would like to give you tips based on criteria and examples to help you with the selection.

1.1 Location

If the teslameter is to be used in a harsh environment, e.g. on the workbench or for incoming goods inspection, we recommend using probes with a brass protective tube, as these are better protected. Experience has shown that the more sensitive plastic probes are damaged or even broken off more quickly.

In laboratory use, on the other hand, handling is usually more careful, so that other decision criteria are in the foreground.

If the device is to be operated at different locations, the handheld devices are better suited for this because you can hold them in your hand and thus use them on the go.

Due to the 19-inch housing, the table-top devices are also suitable for installation in a measurement cabinet.

1.2 Shape of the measurement object

Which type of probe is suitable for the measurement depends on the shape of the object to be measured. In particular, how accessible the measuring point is and in which direction the field lines of the magnetic field run there play a role, since the sensors only measure in one spatial direction. If the field passes through the sensor at an angle, only part of the field is measured according to Bmeas = B0 • cos α.

If measurements are to be taken only on the surface, a flat transverse probe or a vertical axial probe can be used.

The axial probe is used for measurements inside (air) coils or at all points where the field lines run parallel to the probe. This is also the case, for example, with toroidal superconductors.

On the other hand, the transversal probe is ideal for taking measurements in gaps that are perpendicularly penetrated by the field. The plastic probes, which are only 0.8 mm thick, can also be used to measure in very thin gaps. A transversal probe is also suitable for all other measurements in which the probe is aligned perpendicular to the field lines.

For places that are particularly difficult to access, we also offer a flexible transverse probe.

1.3 Size of the measurement object

Large measurement objects are usually uncritical. The smaller the measurement object becomes, the more important the active area of the sensor and the distance to the measurement object become.

The sensors average the flux density over their active area. Therefore, the measurement object should be as large as possible compared to this area.

Problematic here are e.g. very small magnets (2mm or even only 1mm diameter). If you want to measure this, you need a sensor with a very small active area. Our sensors with an active area of 0.13 mm² are ideal here.

The magnetic field decreases with increasing distance to the measuring object. If you want to measure the flux density on the surface exactly, you have to get as close as possible. Again, "dense" is to be seen relative to the object size. With larger measuring objects, minimal distance deviations lead to hardly any significant changes in the magnetic field. With small objects, on the other hand, it sometimes comes down to tenths of a millimeter. Therefore, the plastic versions of the probes are more advantageous here, because the sensor can be placed directly on the measurement object and the brass protective tube is not in between.

1.4 Homogeneity of the magnetic field

Since the sensors average over their active area during the measurement, local changes in the magnetic field that are smaller than the active area of the sensor can no longer be determined. If the magnetic field to be measured is almost constant over a larger area, the area of the sensor only plays a subordinate role.

However, if the course of the magnetic field is to be determined on fine structures, the area of the sensor must be correspondingly small. Examples of this are mechanically structured

surfaces, the magnetic behavior at edges, bores or slots and also magnetic foils with their magnetization alternating in thin strips.

1.5 Strength of the magnetic field

Magnetic fields of up to ±1.8 T can be measured precisely and with high resolution using the table-top devices.

The resolution is lower on handheld devices. Here the measuring range of the probe must be adapted to the strength of the magnetic field to be measured.

The N-probes with their measuring ranges of 20 mT, 200 mT and 2000 mT are suitable for normally occurring technical fields.

Fields greater than 2 T up to 12 T, such as those found in impulse magnetizers or superconductors, can only be measured with the high-field probes.

Smaller fields, on the other hand, can be resolved down to the microtesla range with the L probes (measuring ranges 2 mT, 20 mT and 200 mT). These probes are used, for example, to determine the residual magnetism of workpieces or for magnetic foils

The AS-UAP probe is suitable for weak fields such as the earth's magnetic field (approx. 40 µT to 70 µT) or for measurements to comply with IATA 902 (<0.525 µT at a distance of 4.6 m), which with its measuring ranges 2 µT, 20 µT, 200 µT down to the nanotesla range.

1.6 Frequency of the magnetic field

The desktop devices are designed for measuring DC fields and therefore only have a small bandwidth, typically 100Hz.

If alternating magnetic fields or individual short pulses are to be measured, hand-held devices can be used. A probe should be chosen with a bandwidth large enough for the expected application.

Since the brass protective tube of the probes shields alternating fields, these probes generally have a lower bandwidth (typically 10 kHz to 25 kHz) than plastic probes (typically 35 kHz). Strong alternating fields also cause the brass tube to heat up. The measurement duration with stronger alternating fields (>20 mT) must not be too long with these probes. However, it is more advantageous to use the plastic probes.

Due to its design, the flexible probe is only suitable for frequencies up to 500 Hz.

Short pulses also have higher frequency components, so even measuring individual pulses may require a high-bandwidth probe, depending on the pulse shape.

1.7 Temperature

Almost all of our probes are designed for a temperature range from 0 °C to +50 °C. With the NTP-HOT, we also offer a probe that can be used to measure up to +150 °C.

1.8 Required measurement accuracy / resolution

The hand-held devices have a 4½-digit display and a probe-dependent accuracy of <3% (high-field probes) to <0.2% (normal and low-field probes). This accuracy is also available at the analogue output of the devices. This accuracy is sufficient for most measuring tasks.

The table-top devices achieve an excellent accuracy of 0.01% at the analog output with a temperature drift of <5 ppm / K. Depending on the digit setting, they have a 4½ to 7½-digit display.
In addition, the table devices have a serial interface via which the current measured value can be read out and the device can be controlled.

If a particularly low-noise analog output is required, then the FM 3002 variant is available, the FM 3002-0.1T, which implements this. However, the measuring range is limited to ±100 mT..

2 Advice

In order to make it easier for you to select a device, we are happy to assist you in the implementation of large and small measurement tasks. For this we would like to ask you to contact us.

Of course, we are always there to advise you even after you have purchased a device.

If our devices are not suitable for your area of application, we can also offer you a modification of our series devices or the development of a completely new device. Please contact us about this as well.

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