

APPLICATION NOTE

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Title: Temperature Measurement in an MRI Scanner

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Summary:

Magnetic resonance imaging (MRI) is increasingly used in medical research involving animals. Temperature monitoring of the subject under the MRI scanner is often necessary. The FISO Technologies FOT-M fiber optic temperature gage is the best choice for such situations because it is reliable, easy to use, and is completely immune to electromagnetic interference (EMI). Specially designed for use in the medical field, this gage has several advantages such as its small-scale outside diameter, its high precision, and its very short response time.

Text:

Magnetic resonance imaging (MRI) is increasingly used in the medical field. In an MRI scanner, the patient is placed under a very intense magnetic field produced by the scanner's magnet (60 000 times the earth's magnetic field). The hydrogen nucleuses stimulated in the patient's tissues emit a signal detected and analyzed by a computer, which results in an image of the studied zone. This technique is based on the difference in the tissues' magnetism.

MRI does not require any radiochemistry preparation, contrary to other imaging methods where the injection of radioactive substances is necessary. In the 80's, this technology was considered essential to the diagnosis of several illnesses. It does in fact represents, with great anatomical precision, the inside of the human body in all directions, without the least consequence for the subject. The resulting contrasts allow the detection of the smallest tumors, the tiniest angioma, or vascular accident.

Beyond medical imaging, this method offers new perspectives in animal experimentation from both an ethical and scientific point of view. Only this type of non-invasive imaging allows for the monitoring of the same animal over a long period of time. The number of animals sacrificed is therefore considerably reduced and the repeated use of the same subject facilitates statistical calculations.

Monitoring of the animal's temperature during MRI tests is often essential. The **FISO Technologies FOT-M fiber optic temperature probes** are perfectly suited to applications where there are intense magnetic fields, as in MRIs. In fact, because these gages are made entirely of dielectric materials, they offer complete immunity to electromagnetic interference (EMI). Specifically designed for medical purposes, they are very reliable, easy to use, and have a very short response time. With their accuracy of $\pm 0.3^{\circ}\text{C}$ and a temperature range from -40°C to 85°C , FOT-M fiber optic temperature also have the advantage of a small-scale outside diameter, that is, 0.800 mm.

The neurology department of an American university is currently using an FOT-M temperature gage for studies on rodents. The fiber optic temperature gage is used to monitor the rectal temperature of rodents under a 4.7 Tesla MRI

scanner. The gage cable, which measures 15m, facilitates the installation of the signal conditioner outside the magnetic field. The cables of the FISO Technologies fiber optic gages can be custom-made for a personalized equipment configuration.

Materials used:

- FOT-M fiber optic temperature sensors
- FTI-10 optical signal conditioner (up to 32 channels available)