



MRI manufacturer partners with Prodrive Technologies to gain a 44% increase in gradient strength for the highest quality diffusion imaging

A world-leading MRI manufacturer recently launched a new flagship MRI scanner with an impressive gradient strength of 65mT/m. This gradient strength is made possible by using the NG2250-XP gradient amplifier from Prodrive Technologies. The high gradient amplifier peak power leads to ultrafast MRI scanning, higher scan resolution, and a higher signal-to-noise ratio.

Increased gradient amplifier reliability is needed

MRI (Magnetic Resonance Imaging) scanners demand a significant amount of power from the gradient amplifier to operate. Power, accuracy, and repeatability are all important factors to the overall MRI equipment's performance. With high gradient amplifier peak power, scan times can become faster, while maintaining or increasing the image quality.

To get the performance needed, at the heart of every MRI scanner is a gradient power amplifier that boosts the energy of the incoming signal before it reaches the gradient coils. Along with the large magnets used in the MRI machine, the gradient power amplifier is arguably the most important electronic component in the whole system in terms of both performance and value.

The challenge with high gradient peak power is that during the peaks, the semiconductor power components are subject to high thermal stress. Excessive thermal stress leads to power component failure, which then results in downtime for the MRI system.

In this case, the MRI manufacturer wanted more power to perform highly demanding sequences. With the NG2250-XP from Prodrive Technologies, this problem has been tackled by designing the gradient amplifier to operate at very low thermal stress which yields to longer lifetime and lower failures rates. This is achieved by combining state-of-the-art concepts with leading technologies.

A new way to bring down the thermal stresses on power amplifiers

Prodrive Technologies developed a high-power gradient amplifier that brings down the temperatures, which helps extend their life significantly. This was integrated into a new flagship MRI scanner.

As a result, the new MRI machine now serves the most demanding requirements in the area of Diffusion and Neuroscience imaging providing gradient intense scans with high accuracy and high duty cycle. It offers high quality gradient chain by connecting the gradient coil with a high powered 2.4MVA gradient amplifier from Prodrive Technologies.

The high-power gradient amplifier enables this particular customer to achieve 65mT/m.

The development journey

Prodrive Technologies already had a long-term relationship with the MRI system manufacturer who was looking to further enhance their products with the latest technological advances. At the same time, Prodrive Technologies had recently developed and launched an off-the-shelf gradient amplifier with the highest power specifications in the industry, the NG2250-XP.

By achieving the additional specifications, it made it possible for the customer to perform new, intensive applications, especially for neuroimaging. This led to successful initial investigations and testing, followed by an actual project where the NG2250-XP amplifier was tailored and flawlessly integrated with the customer's console in such a way that communication can take place between the gradient amplifier and the control system.

The results were exciting meaning the manufacturer was able to deliver a breakthrough in diagnostic quality and speed.

Prodrive Technologies high powered amplifier for MRI machines

A gradient amplifier is a device that very precisely supplies power to the gradient coils during magnetic resonance imaging and is typically up to 2m high by 1m wide and 1m deep. It is a system that amplifies the signals that come from the spectrometer (sometimes referred to as a pulse sequencer) and sends them to a 3-axis gradient coil that is inside the main magnet to create a gradient in the magnetic field in 3D space.



In MRI systems, the gradient amplifier generates pulsed currents through the gradient coils, in a way that the field strength is intense enough to produce the variations in the main magnetic field for localization of the later received signal. Typically, one gradient coil would consist of three axes and normally require a 3-axes gradient amplifier.

With the aforementioned power levels, heat dissipation and cooling are always a challenge. The gradient amplifier is a highly integrated piece of equipment where high-performance power electronics are combined with advanced control software and integrated water and air cooling system.

Delivering the extreme precision and repeatability needed, Prodrive Technologies has created a high-power gradient amplifier that takes the MRI industry forward for the benefit of medical science and individual patients.

Prodrive Technologies worked as a true collaborative partner in the project with strong cooperation between Prodrive Technologies and the customer, with on-time delivery of production models.



Furthermore, as part of the system, Prodrive Technologies also integrated its own XPCS current sensor in the package which features highly precise zero flux gate sensing technology. Like many other key components in the gradient amplifier, this is something the MRI manufacturers would normally have to source separately. Prodrive Technologies can act as a one-stop shop by offering all three amplifier types that are found in MRI scanners, namely the gradient amplifier, RF amplifier, and high order shim amplifier (an option required in some cases).

The next steps in amplifiers for MRI applications

Prodrive Technologies is actively pursuing its roadmap by developing the next generation of amplifiers which feature advanced silicon carbide materials to push the technology and benefits even further.

Discover more about Prodrive Technologies' solutions for the medical industry.

<https://prodrive-technologies.com/markets/medical/>

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