

FIBRE OPTIC ROTARY JOINTS: **Enabling Scalable, Secure, and Long-Lasting Wind Turbine Performance**

Fibre Optic Rotary Joints (FORJ) are a widely adopted technology in wind turbines for nacelle to hub communication. In this article, the strengths of FORJ are discussed in the context of wind turbines, but of course these rotary communication devices are transferrable to many other application and industries including tidal turbines, Remotely Operated Vehicles (ROV), manufacturing equipment and radar to name but a few.

Why Choose Fibre?

First and foremost, fibre's greatest strength is signal integrity. Brushed electrical slip rings are known to generate noise through the sliding electrical contact that the signal passes through. Whilst there are management strategies to counter the effect of lost packets of data in the communication protocols, these sliding contacts do degrade over time and the data rate ceiling is often limited to 100Mbps. FORJs are optical transmission devices and as such there are no moving physical contacts and so zero-loss signal transmission is possible at rates of 1Gbps and above.

With the current bandwidth capabilities and the advances in data-centres and networking there is a clear pathway for higher data rates for fibre optic devices.



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There is a commonly quoted “law” known as Enholm’s law, that predicts bandwidth requirements will roughly double every 18 months. This demand for increased data rate is, and will continue to be driven by increased condition monitoring and more complex control mechanisms for wind turbines to optimise asset uptime and performance. With this considered, it is expected that data rates of 1Gbps will be required for wind turbines by 2030. With fibre, there is a clear technology roadmap up to 10Gbps and higher.

Because fibre is more future proof as a technology and would need replacing or upgrading less often, it offers the ideal platform for security updates to both new and legacy equipment. Let’s not forget the enormous and potentially vulnerable legacy fleet of equipment (both turbines and other technologies) out in-field. Harmful cyber attacks are on the increase, with a number of successful and disrupting wind farm attacks in Europe in 2028 expected to be double the number seen in 2022. Similar trends are observed in the USA. To protect energy production assets, or indeed other critical assets/networks, a stable physical-layer with good backwards/forwards compatibility is needed for the effective roll out and update of security protocols.



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Fibre optic cables are also non-conductive and immune to electromagnetic radiation. This makes them a good choice for communication in applications that have large varying electromagnetic fields, such as wind turbine generators. Furthermore, for assets that are isolated and vulnerable to lightning strike or suffer from transient voltage surges of some form or another, use of fibre cabling allows for the easy isolation of sensitive electronic equipment.

For the reasons stated above, fibre optic infrastructure, including FORJ is the most cost effective and secure solution over asset lifetime. For a comparable cost of installation, the end user or operator can experience reduced maintenance, increased lifetime and require fewer upgrades.

Visit our website or contact our technical team for any enquiries or support in specifying a fibre optic rotary joint for your industrial application.

View our range of FORJs on our [catalogue webpage](#).



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