

## Wind Energy Solutions

- **Slip Rings**
- **Fluid Rotary Unions**
- **Fibre Optics**
- **Integrated Assemblies**



### **Wind Power Series** **High Reliability Rotary Union Products**

Modern wind turbines require delivery of power and signals to and from the rotating blades by a reliable rotary union assembly. These assemblies must operate continuously in harsh environments, often in remote locations where regular maintenance and monitoring are difficult and expensive.

Moog Components Group's line of Wind Power (WP) products are designed to last in this tough environment.

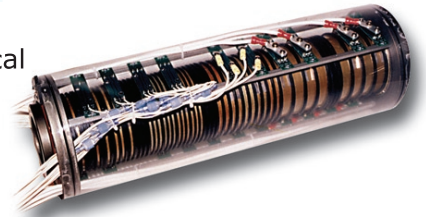
**Slip Rings** utilising fibre brush sliding contact technology are "no maintenance" rotary devices. This fibre brush contact system eliminates the need for common slip ring maintenance procedures — no vacuuming of brush debris, no lubrication, no regular inspection for brush wear, no brush replacement, no maintenance.

**Fluid Rotary Unions** for hydraulic power transfer utilise an innovative low leak, long life design. These fluid rotary unions can be combined with slip rings for integrated rotary union solutions.

**Fibre Optic Systems** include multiplexers and fibre optic rotary joints that allow multiple signals to be carried on a broad bandwidth fibre optic line. Fibre optic systems are usually used in combination with slip ring capsules.

## Design Solutions

Slip rings are commonly used in wind turbines to provide electrical signals and power for blade pitch power and control, and fluid rotary unions (FRUs) carry hydraulic actuation power where needed. Moog Components Group uses innovative design solutions in both of these components to meet the unique requirements of the wind turbine application.



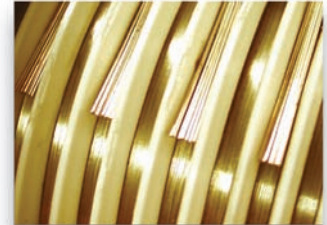
### Slip Rings

Fibre brush technology enables a maintenance-free slip ring design. In the 1970s, Moog Components Group recognised the value of this technology for long life, space efficient slip rings and patented

#### **Fibre Brush Advantages:**

- Maintenance free for 100 million revolutions
- Minimal wear debris generation
- No lubrication required
- Wide operating temperature range
- Lower life cycle cost

the approach that has led to hundreds of different slip ring designs for challenging applications including helicopter rotor blade de-icing, satellite solar array drive power transfer, industrial packaging equipment, radar pedestals and wind turbines



Tests have demonstrated fibre brushes operate continuously with no degradation of electrical performance for over 100 million total revolutions, **With No Maintenance.**

to name just a few. The unique feature of the fibre brush technology is its ability to achieve remarkable life without lubrication over a wide range of temperature, humidity and rotational speeds. In addition, the fibre brush has the capability of very high electrical current density. Slip ring options are available for all common data networks including Profibus, 100BaseT Ethernet and CANbus. Patented "broadband" digital data transmission techniques are utilised to ensure error-free data transmission.

#### **Additional Slip Ring Features:**

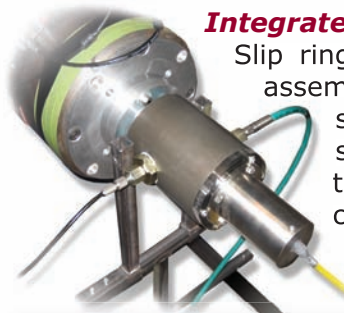
- Precision ball bearings, sealed and lubricated for life
- Rugged structure and enclosure using corrosion resistant materials and coatings
- Reliable electrical interface including custom connectorisation
- Environmental protection designed to meet IP65 requirements

### Fluid Rotary Unions (FRUs)

Hybrid hydraulic/electric systems require both electrical and fluid transfer to and from the turbine blades. While slip rings provide the electrical transmission across the rotary interface, fluid transfer is accomplished through fluid rotary unions (FRUs). Typically, two fluid channels are required to provide supply and return hydraulic power to the blade actuators. Special seals and shaft coatings have been developed to ensure long life of these FRUs. Seals are selected based on chemical compatibility, design pressure, design temperature, required service life and acceptable leakage rate. Leak collection can be supplied when required for environmental or personnel safety.

#### **Integrated Rotary Union Solution**

Slip rings are often integrated with fluid rotary unions into rotary union assemblies. It is also becoming more common to include rotary position sensors and fibre optic rotary joints for a complete rotary interface solution. Special techniques are required in these integrated assemblies to ensure the reliable operation of the each of the specific functional components.

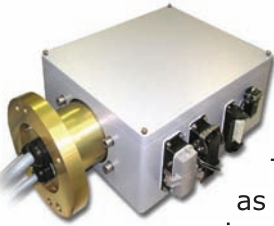
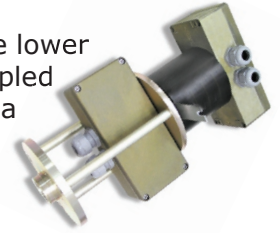


Special test rigs are used to test FRU leak rates and life.

## Products

The Moog Components Group WP line of rotary products offers standard design configurations for the two prominent turbine configurations — slip rings and fluid rotary unions for hydraulic/electrical systems and high power slip rings for electric/electric systems.

**WP6807:** The WP6807 slip ring provides multiple signals and power for the lower power requirements of the hydraulic/electric designs. This slip ring can be coupled with a fluid rotary union to provide hydraulic power to the actuators and a fibre optic rotary joint can be integrated into the design to handle high speed data lines. The WP6807 features sealed junction boxes for reliable electrical termination, as well as special fluid rotary union mounting options.



**WP6808:** The WP6808 slip ring provides multiple signal and low power options combined with high power circuits required for electric blade pitch actuation. A fibre optic rotary joint can also be integrated into this design. The fibre brush design utilized in the WP6808 allows high current circuits, as well as signal currents to be combined in the same assembly using identical precious metal contact material. The low wear debris generation feature of the fibre brush design prevents the common problem of shorting and arcing of high power circuits using graphite brushes.

**WP6923:** The WP6923 fluid rotary union provides hydraulic power and return to the wind turbine rotor. Special seals and shaft coatings have been integrated into a proven design to ensure long life and low leak rates. Typically, the WP6923 is integrated with a WP6807 slip ring, but it is also available as a stand-alone unit.



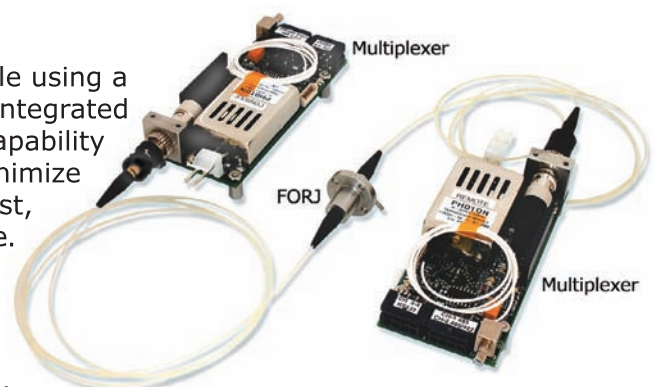
**WP6924:** This is an integrated slip ring and fluid rotary union specially designed for hydraulically actuated pitch control systems. This unit provides environmental protection for the assembly as well as internal isolation of the electrical circuits from the hydraulic circuits. The WP6924 is the total rotary system solution for hydraulic/electric wind turbines and can be integrated with a FORJ to provide high bandwidth and low susceptibility to electromagnetic interference (EMI).



### Fibre Optic Data Transmission

Optical data transmission techniques are available using a complete line of Fibre Optic Rotary Joints (FORJs) integrated into the rotary unions. The very high bandwidth capability of fibre provides tremendous opportunity to minimize the number and size of cables — reducing cost, improving reliability and improving EMI performance.

Fibre optic communication systems are used to multiplex multiple single channels onto a single optical fibre. In the case of wind turbines, fibre optic systems are developed to carry multiple, bidirectional signals from the turbine blades all the way to the base of the tower on a single fibre. These fibre optic systems can transmit the common fieldbus protocols including Ethernet and CANbus. Since this fibre channel to and from the turbine blades cross a rotary interface, a fibre optic rotary joint (FORJ) is required. These FORJs are highly reliable, non-contacting devices suited to hundreds of millions of revolutions and can be integrated into rotary unions.



## Wind Turbine Solutions


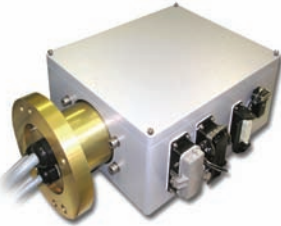


| <b>WP6807 Slip Ring</b>   |                    |   |   |
|---|--------------------|---|---|
|    | Signal Circuits    | 6 - 24  | 10 Amps each continuous   |
|   | Power Circuits     |   | All circuits can be paralleled for 240 Amps max.                            |
|   | Features           |   | Can be integrated with fluid rotary union or used as a stand-alone assembly |
|   |                    |   | IP65  |
|   |                    |   | Terminal strip electrical interface in sealed enclosure                     |
|   | Options            |   | Alternate electrical interface  |
|   |                    | Alternate IP rating                               |   |
|   |                    | 1 1/2 inches (38.1 mm) through bore               |   |
|   |                    | Integrated hydraulic fluid rotary union           |   |
| <b>WP6808 Slip Ring</b>   |                    |   |   |
|    | Signal Circuits    | 18 - 72   | 10 Amps each continuous   |
|   | Power Circuits     |   | 20, 50, 100, 200, 300 Amp RMS continuous @ 600 V                            |
|   | Features           |   | IP65 enclosure  |
|   |                    |   | Connectorisation options on both rotor and stator                           |
|   | Options            |   | Alternate IP Rating   |
|   |                    | Custom mounting provisions                        |   |
|   |                    | Integrated FORJ or speed/position feedback device |   |
| <b>WP6923 Fluid Rotary Union (FRU)</b>  |                    |   |   |
|  | Hydraulic Channels | 2   | 200 or 345 bar working pressure   |
|   | Flow Rates         | 20 Lpm  | 3/8 inch & 1/2 inch BSPP (9.53 mm & 12.7 mm)                                |
|   |                    | 50 Lpm  | 1/2 inch & 3/4 inch BSPP (12.7 mm & 19.5 mm)                                |
|   |                    | 100 Lpm   | 3/4 inch & 1 inch BSPP (19.5 mm & 25.4 mm)                                  |
|   |                    | 150 Lpm   | 1 inch & 1 1/4 inch BSPP (25.4 mm & 31.75 mm)                               |
|   | Features           |   | Low leak rate   |
|   |                    |   | Designed for integration with WP6807  |
|   | Options            |   | Separate housing drain, other port types, flow rates and working pressures  |
|   |                    | Custom mounting provisions                        |   |
| <b>WP6924 Integrated Rotary Solution</b>  |                    |   |   |
|  | Electrical         |   | See WP6807  |
|   | Hydraulic          |   | See WP6923  |
|   | Features           |   | Isolated electrical and hydraulic channels                                  |
|   |                    |   | Connectorisation options or both hydraulic and electrical connections       |
|   |                    |   | Custom mounting provisions  |
| Options   |                    | Integrated FORJ or position feedback device       |   |

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