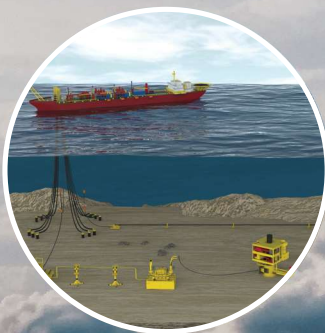
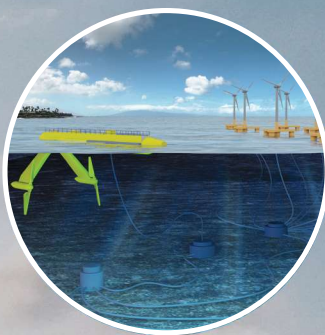


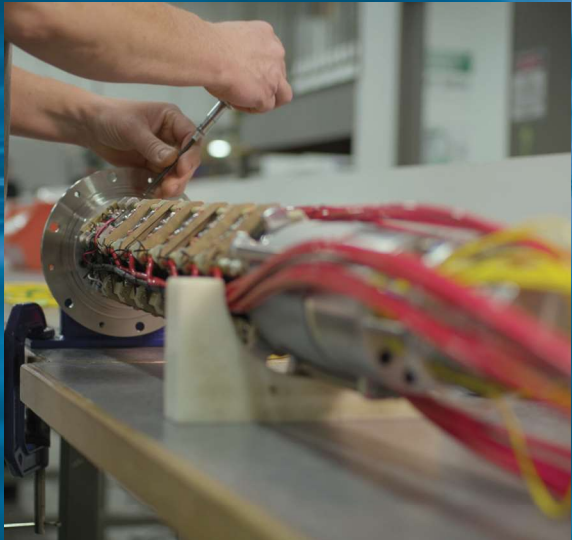


Product & Application Overview

MOOG
FOCAL™

Moog Focal: Highly Reliable Marine Rotary and Data Transfer Solutions

Focal Technologies, a Moog Inc. company, has had one focus over the years – responding to the global demands for power and data transmission solutions. Moog Focal specializes in providing electrical slip rings, fiber optic rotary joints, hydraulic utility swivels and fiber optic multiplexer solutions for the worldwide marine industry, including ROV, seismic, FPSO turret, and oceanographic applications. Moog Focal is a worldwide designer, manufacturer and integrator of precision control components and systems.



Moog Focal provides a wide range of rotary and electronic product lines including:

- Electrical Slip Rings
- Fiber Optic Rotary Joints
- Multiplexers, Media Converters and Modems
- Networking and Sensor Systems
- Fluid Rotary Unions
- Floating Production Systems
- Condition Monitoring

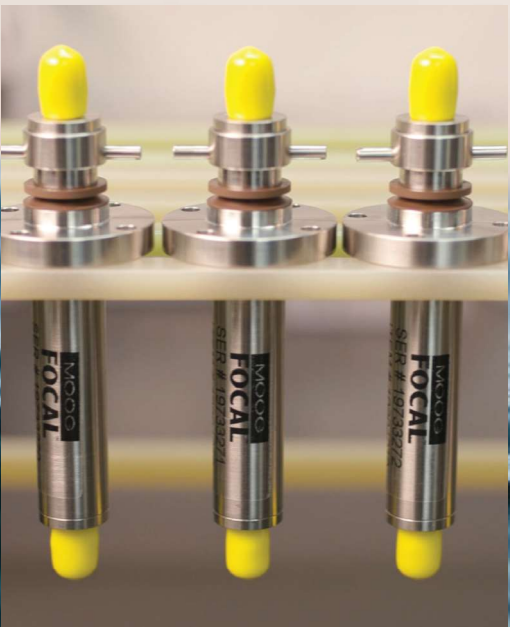
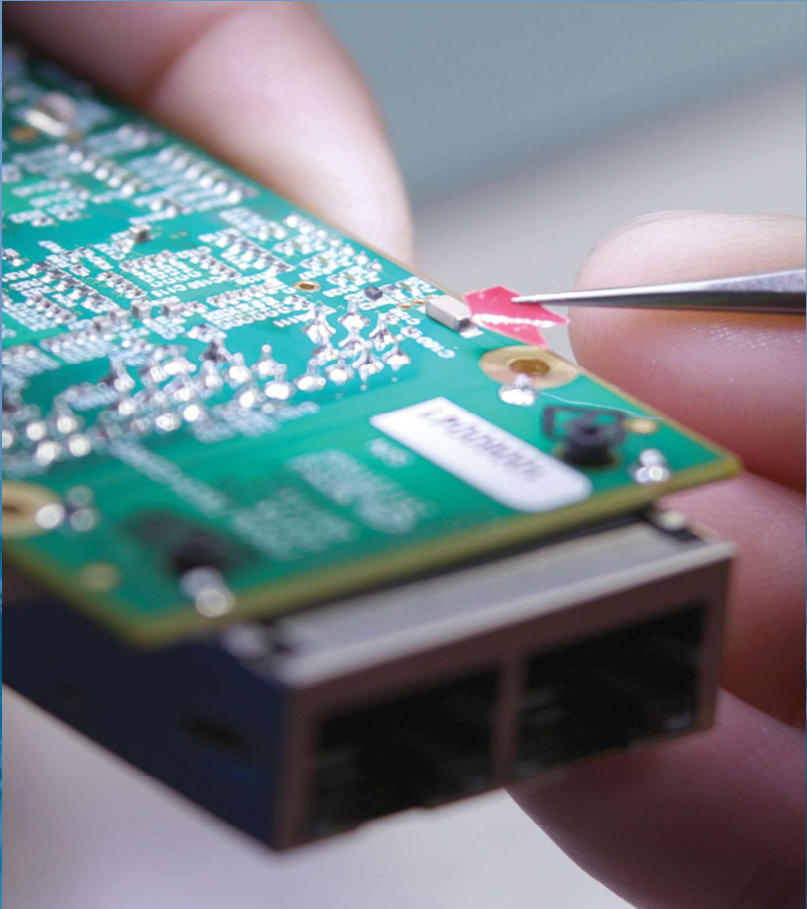
Our approach to solving power and data transmission challenges is simple - innovation and performance in all that we do. That means products that consistently perform in the world's harshest environments, people that consistently exceed expectations, and innovative custom solutions and services that set the pace in today's rapidly changing global markets.

We have delivered trusted technology products and services to the offshore petroleum, oceanographic, seismic, and maritime industries for more than 30 years. Working from our well-equipped facility in Halifax, Nova Scotia, Canada, we have earned a reputation for unsurpassed service and custom solutions.



Our knowledgeable engineering staff can help at the beginning of a project with selecting standard products or configurations, or work closely with you to design custom solutions that meet your unique needs. Project management services are available to help get your system to market on time and on budget.

From design to deployment, our experienced team of professionals specializes in providing custom electrical, fiber optic, fluid swivels, and optical multiplexer solutions for the worldwide marine, industrial and defense industry. Product offerings include hybrid packages that combine fiber, electrical and fluid swivels, packaging for harsh environments, certification for hazardous locations, and adaptation to customers' size and mounting constraints.



We are the first stop for the design, manufacturing and project management of marine and energy integrated power and data solutions. From our ability and willingness to customize products, to our ISO 9001 certification, and our expansive global reach, we are defining and delivering custom integrated and proven products for the harshest marine environments in the world.

Moog Focal's products are used in applications all over the world, including:

- Remotely Operated Vehicles (ROVs)
- Floating Production Systems (FPS)
- Defense
- Renewables
- Subsea Oilfield Communications (SOC)
- Oilfield and Downhole

Remotely Operated Vehicles (ROVs)

Reliable Power and Communication Systems

Moog Focal designs and supplies highly reliable communication systems and components to the ROV industry. With thousands of fielded systems for applications ranging from small inspection class up to large work class ROVs, our broad portfolio offers a variety of package sizes and capabilities to suit a wide range of requirements.

Moog Focal multiplexers combine all ROV controls, video, sonar, and sensor data into reliable, low latency optical communications. With extensive diagnostics and built-in redundancy options, these multiplexers consistently deliver a verifiable and dependable link between pilot and vehicle.

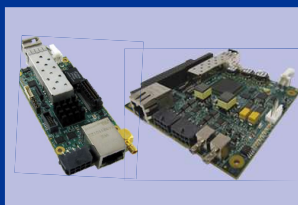
Moog Focal supplies purpose-built, pressure compensated electrical-optical slip rings for use subsea in the Tether Management Systems (TMS). When used in combination with multiplexers, all sensors and cameras in the TMS are provided with a reliable power and communications link to the surface.

Condition Monitoring

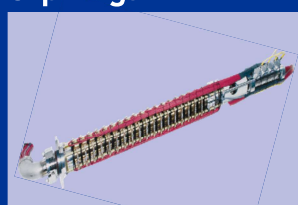
Moog Focal's Optical Monitoring System (OMS) provides real-time health status of the entire optical cable installation. By continuously testing all connections, couplers and fibers, including those with live data, the OMS can quickly identify and pinpoint emerging faults, simplifying troubleshooting and significantly reducing downtime.

Slip ring sensors provide real-time status for both surface and subsea electrical-optical slip rings. Rotational speed, total rotations, temperature, humidity, and many more parameters can be monitored in real-time as well as logged. This information can be combined with the OMS and multiplexer diagnostics to provide complete system health and status. This comprehensive diagnostic portfolio reduces downtime and saves operational costs.

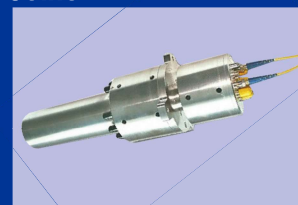
Multiplexers and Media Converters



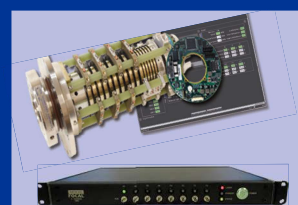
Electrical Optical Slip Rings



Fiber Optic Rotary Joint



Condition Monitoring



Electrical Slip Rings



For more information, please consult our Electronics Product Guide

Floating Production Systems (FPS)

How Does Your Turret Stack Up?

Moog Focal provides a complete product line of rotary and electro-optical equipment for the swivel stacks of Floating Production Systems (FPS), including: Fiber Optic Swivels, Toroidal Fluid Swivels, Electrical Swivels, Wavelength Converters, Multiplexers and Ancillary Equipment. We have successfully delivered more than 175 FPS swivel projects over the last 30 years.

Moog Focal Can Help You Optimize

Swivel stacks can take various configurations and at the design stage the decisions are not always obvious. There are many factors in determining where components are best placed, and having supplied and integrated most components in swivel stacks, Moog Focal is ideally positioned to help optimize those variations. Our goal is to always minimize stack cost, height and weight, while maximizing performance. We have developed design methods and tools that allow us to quickly consider space requirements through the bores, cable de-rating due to high temperatures, signal and optical data transmission, mechanical loading, and various other parameters. Engage us early in your project when you're planning how your turret will stack up, and we will save you time and money.

Our customers want to protect their investment. One of the most important things they can do is ensure that equipment is installed correctly. We have a team of offshore trained and certified technicians and engineers that can provide proper installation and commissioning of our products. We will work with our clients and others at the installation site to ensure the installation is done safely with quality workmanship and in a timely manner.

Product Offerings:

- High Power Electrical Swivels
- Electronics (Communications, Condition Monitoring)
- Toroidal Fluid Swivels
- Fiber Optic Swivels
- Custom Junction Boxes (Ex d, IP68, Medium Voltage)
- Electrical signal and Utility Power Swivels

For more information, please consult our Floating Production Systems Brochure.



Defense Rugged & Reliable Technology

Today's defense markets are changing to meet a new generation of global requirements. High performance products must operate in extreme environments and be built on flexible platforms that support cost-effective upgrades in future. Moog Focal has decades of experience with both custom and ruggedized COTS solutions for defense applications, to meet these challenges.

Moog Focal products are serviced by international sales teams, customer support representatives and manufacturing operations in 26 countries facilitating multinational opportunities. When a customer needs tailored support, program management can work as an integral part of the development team.

Moog Focal products are used on numerous military programs and platforms.

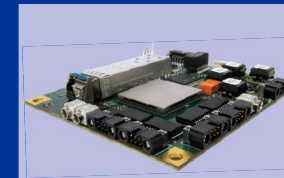
Applications include:

- Naval Towed Arrays
- Armored Vehicle/Remote Weapon Station
- Missile and Air Defense
- Electro-Optical/Infra-Red (EO/IR) Advanced Targeting Pod
- Unmanned Aircraft Systems (UAS)
- Radar/Satcom
- Commercial and Military Aircraft/De-ice

DEFENSE

DEFENSE

Multiplexers



HD, Ethernet and Serial Data

Fiber Optic Rotary Joints



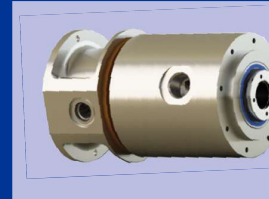
Single and Multi-Channel,
Single-Mode and Multi-Mode

Hybrid Rotary Unions



Fluid Rotary Union, Slip Ring
and Fiber Optic Rotary Joint

Fluid Rotary Unions



Multi-pass High Pressure
Fluid and Gas

Electrical Slip Rings



High Voltage/Current

Renewables

Reliable Low Maintenance Solutions

Moog Focal's high voltage swivels, electrical, fiber optic and fluid rotary unions are used for surface and subsea applications to enable the transfer of power, signals and fluid across a rotary interface. Wind energy and tidal stream turbines typically use active blade pitch control systems to efficiently harvest the local wind and tidal energy available. Moog Focal electrical and fiber optic rotary joints are integrated into blade pitch control systems to transfer power and signals between the turbine nacelle and hub. In tidal turbine applications the turbine platform may need to rotate in the tidal flow to ensure the energy is exported seamlessly via the seabed umbilical. To help solve this challenge, Moog Focal has designed robust high voltage swivels enabling the transfer of power and signals from the tidal turbine to the export cable. Moog Focal swivels can also be incorporated in floating offshore wind platforms to enable the turbine to passively weathervane while transmitting power and signals to the export cable.

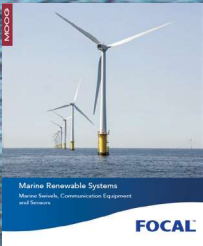
Product Offerings:

- Medium Voltage Swivels
- Electrical Slip Rings
- Fiber Optic Rotary Joints
- Subsea Junction Boxes
- Fiber Optic Multiplexers
- Condition Monitoring

RENEWABLES

RENEWABLES

For more information, please consult our Marine Renewable Systems Brochure.



Subsea Integrated Solutions for Drilling and Production

Field-Proven and Qualified Solutions

Robust and highly reliable Subsea Integrated Solutions (SIS) designed to meet the requirements of Drilling and Production Controls

Product Offerings:

- Subsea Electronic Modules
- Electrical and Optical Flying Leads with Media Converters
- Subsea Power Systems
- Subsea Sensors
- Subsea Motor Drives
- Subsea Hydraulic Assemblies
- Subsea Electro Hydraulic Manifold and Pumping Systems
- Various Subsea Components Including Ethernet Switches, Fiber Modems, Optical Transceivers, Long Range Copper Modems, Gateway and I/O Module, Power Data Swivels and Slip Rings

Product Highlights:

- Reliable continuous operation for more than 20 years in subsea applications
- Q2 qualification to API 17F/16D/Q1-Q2 Requirements
- Compatible with multiple subsea standards including SIIIS
- Extensive diagnostics

Services:

- Custom Engineering Design
- Qualification Testing
- System Integration Testing
- Offshore Installation and Commissioning
- Product Lifecycle Management

Applications include:

- Blow Out Proventor (BOP) Control Systems
- Subsea Production Control Systems
- Wellhead Controls
- Subsea Distribution Systems

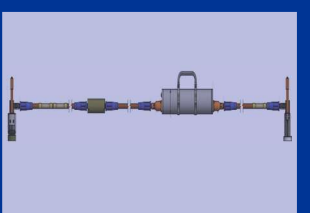
Subsea Electronics Assemblies



Condition Monitoring



Flying Leads



For more information, please consult our Subsea Oilfield Communications Brochure.



SUBSEA INTEGRATED SOLUTIONS

SUBSEA INTEGRATED SOLUTIONS



Drilling can now extend to depths of 10 km and can be multi-directional or horizontal. Temperatures and pressures can be up to 200°C and 1700 bar (25,000 psi). The cost to recover the reserves is critical to project viability, and as a result maximizing efficiency is imperative.

Since 1998, Moog Focal has worked with the major oilfield service companies and equipment manufacturers to solve demanding and unique problems for the difficult downhole environment.

The need to maximize output from new and existing reserves requires the need for higher performance equipment and better information from the well. To answer the demand, Moog Focal has developed a line of oilfield and downhole equipment and technology that meets the challenge.

We didn't stop at design – Moog Focal has also developed processes and test equipment to ensure that our products will perform both at surface and in the deepest, most challenging wells.

Moog is fully certified to North American, ATEX and IECEx standards for hazardous area qualifications. Designs are available for harsh oilfield conditions that are configured for electrical power, signals or both. These designs can be integrated with other products such as Fiber Optical Rotary Joints and Fluid Rotary Unions.

Some downhole tools and surface winches require an electrical rotary interface. A number of designs are available to work in the harshest conditions. These designs also fit into well diameters typical of the industry, work at 1700 bar (25,000 psi) and 200° C and are able to carry electrical power and signals.

Applications:

- Wireline
- Top Drive
- Coil Tubing
- Measuring/logging while drilling
- Winches
- Downhole tools

Oilfield & Downhole Solutions for Harsh Environments

Moog Focal products are serviced by international sales teams, customer support representatives and manufacturing operations in 26 countries facilitating multinational opportunities. When a customer needs tailored support, program management can work as an integral part of the development team.

Product Offerings:

- Multi-Channel Fiber Optic Rotary Joints, Single-mode or Multi-mode Fiber Electrical Slip Rings
- Multi-Pass Fluid Rotary Unions with Electrical Slip Ring and Fiber Optic Rotary Joints
- Subsea Junction Boxes
- Downhole High Temperature / High Pressure Slip Rings
- Fluid Rotary Unions
- Explosion-Proof Electrical Slip Ring

Hybrid Rotary Unions



Fiber Optic Rotary Joints



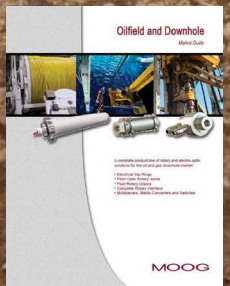
Downhole Slip Ring



Hazardous Area Slip Ring



Fluid Rotary Unions



For more information, please consult our Oilfield & Downhole Brochure.



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