

# Marine & Energy

*Product Guide*



**A complete product line of rotary and electro-optic solutions for the most demanding applications.**

- Remotely Operated Vehicles (ROVs)
- Seismic Surveying
- Oceanographic Winches
- Subsea Communications
- Floating Production, Storage and Offshore Loading (FPSO)

**FOCAL™**

**MOOG**

# Marine & Energy



Over the years, we have had one focus and that is answering the global demands for innovative power and data transmission solutions. In 2005, Focal Technologies was acquired by Moog Inc. By combining these leading-edge companies, new strengths and resources emerged. The Focal™ product line continues to solve the demanding challenges of the marine and energy industry.

## Electrical Slip Rings

Designed to function in extreme marine environments, our electrical slip ring units are used around the world for reliable power and signal transmissions in marine surface and subsea applications.

## Fiber Optic Rotary Joints

For more than 20 years, our company has focused on the rotary interface needs of the marine and energy industries. Today, our fiber optic rotary joints (FORJs) are recognized around the world for innovative performance and reliability in harsh marine environments.



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 20 years. Working from our well-equipped facility in Halifax, Nova Scotia, Canada, we have earned a reputation for unsurpassed service and custom solutions.

From design to deployment, our experienced team of professionals specializes in providing custom electrical slip rings, fiber optic rotary joints, hydraulic utility swivels and fiber optic multiplexer solutions for the worldwide marine industry. Product features include hybrid packages that combine fiber, electrical, and fluid rotary joints, packaging for harsh environments, explosion proof / flameproof for hazardous locations, and adaptation to customer's size and mounting constraints.

As the first and only stop for the design, manufacturing and project management of marine and energy integrated power and data solutions, we specialize in the following areas:

- Remotely Operated Vehicles (ROVs)
- Seismic Surveying
- Oceanographic Winches
- Subsea Communications (e.g. Well Control)
- Floating Production, Storage and Offshore Loading (FPSO)

Innovation and performance are incorporated in all that we do. From our ability and willingness to customize products, to our ISO 9000 certification, to our unmatched global capacity, we are defining and delivering custom integrated and proven solutions for the harshest marine environments in the world.

### FPSO Swivels

We have designed, manufactured and delivered more than 40 large, complex FPSO swivel assemblies to offshore operators worldwide.

### Fluid Rotary Unions

Introduced in the mid 1970's to serve in diver life-support umbilical systems, our fluid rotary unions have been diversified to include a broad range of applications.

### Fiber Optic Multiplexers and Media Converters

Our multiplexers were developed to provide reliable fiber optic transmission of video and data signals in the demanding subsea applications of ROVs, robust defense systems, and other platforms operating in harsh environments around the world.



# Electrical Slip Rings



Designed to function in extreme marine environments, our electrical slip ring units are used around the world for reliable power and signal transmissions in marine surface and subsea applications.

## Model 129

With a diameter of 12.8 inches (32.5 cm), this high power unit is designed to meet the needs of high current, heavy-duty applications.



## Model 159

Similar to the Model 176, the Model 159 can be designed for higher current applications. Each pass can be rated up to 50 amps.



*Note: Selected slip ring photos are shown without their standard stainless steel enclosure for clarity.*

## Diverse Applications

Used in the majority of current work-class ROV models and underwater trenchers, geophysical, oceanographic and other winches, our electrical slip ring units are customized for the most demanding environments. The Model 176 is a versatile design found in applications as diverse as Remotely Operated Vehicle systems, both surface and subsea, towed arrays used by various navies, seismic exploration, subsea control systems and oceanographic monitoring installations. The Model 180 is used in smaller winch systems such as those for oceanographic sensors and small ROV systems. In fact, our electrical slip rings were used in the discovery of the Titanic and the Bismark.

## Broad Range of Sizes, Powers and Number of Passes

Ranging in diameter from 2.9 inches (7.4 cm) to 12.8 inches (32.5 cm), our electrical slip rings are designed to application requirements. Units can be designed for voltage ratings from signal to 6600 V and current ratings to hundreds of amps. Higher power models, like the Model 129, are rated for continuous service to 175 A, 5000 V per pass. Signal slip rings carry from 2 to more than 200 passes. One Model 129 unit was custom designed to accommodate 600 circuits.

## Custom Engineering

Innovative engineering is our heart and soul. Our professional engineers and designers are experienced in providing custom designed electrical slip rings for a wide array of applications and are always eager to take on new challenges. Our engineers conduct in-depth research into each application's unique requirements and work collaboratively with customers to deliver the best design for their needs. Almost half of our units are customized to meet unique performance requirements.

## Model 176

A versatile model with a wide variation of voltage and current capabilities. Can accommodate our single and multi-pass fiber joints and be combined with air passes and fluid unions.




## Hybrid Units

Highly configurable, our electrical slip ring units can be combined with our fluid rotary unions and fiber optic rotary joints, as well as fiber optic multiplexers for a total rotating interface solution.

## Typical Uses

- Remotely operated vehicles
- Towed arrays and seismic streamers
- Oceanographic winches
- Cable reels
- Sonars
- Subsea cameras
- Industrial rotary tables
- Industrial machinery

## Hazardous Locations Classifications Available (Model 176 and Model 180)

- Class I, Group C, D and Class 1, Zone 1, Group IIB (CSA)
- KEMA certification: ATEX  II 2 G EEx de IIA or IIB T5 (ATEX directive 94 / 9 / EC)
- Can be supplied with purge fittings for use with a certified purging system
- Can be used as simple apparatus in intrinsically safe systems (EN 50020)
- Can be certified as associated apparatus (EExd [Ib] IIB T5) on special order (EN 50020)

## Options

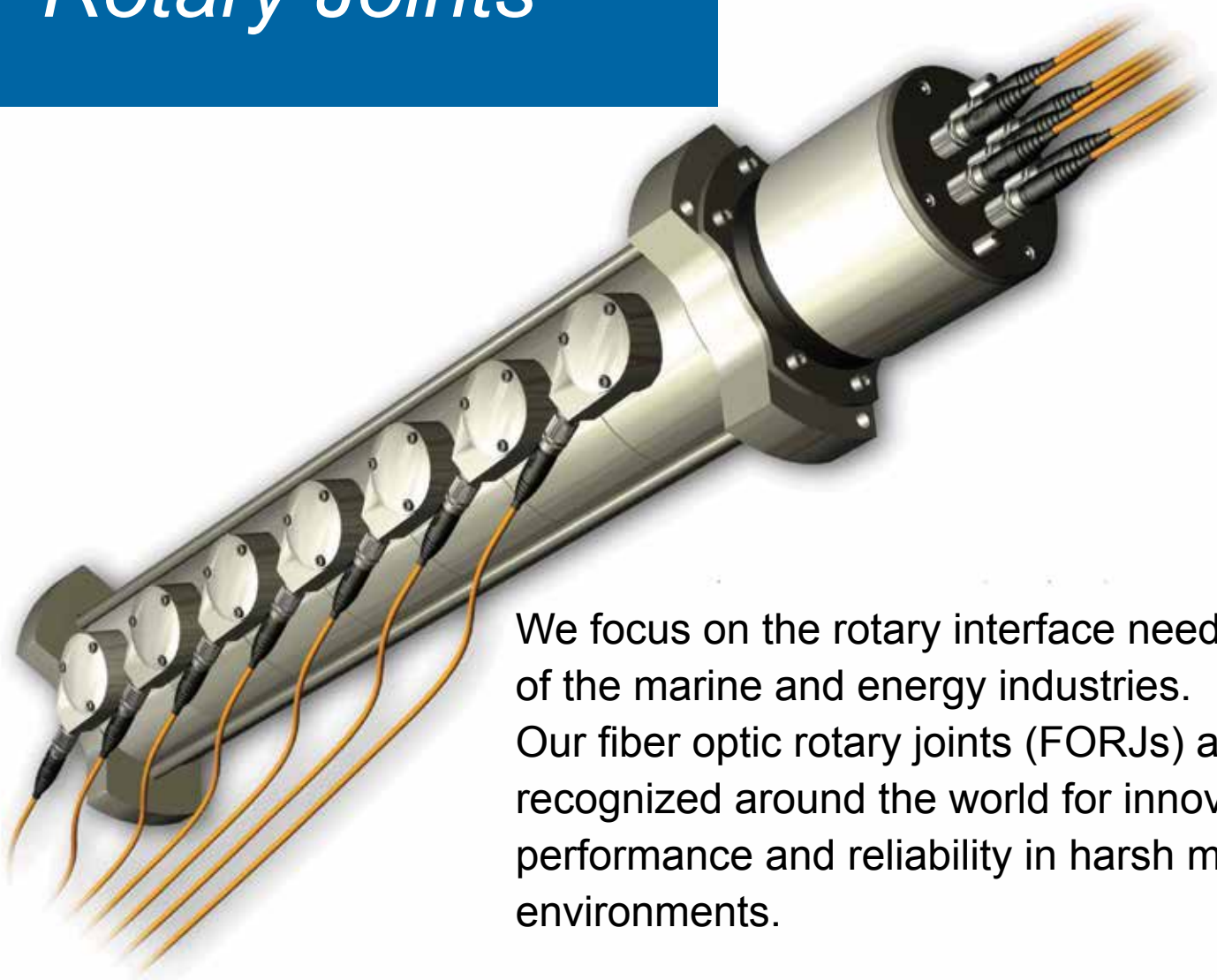
- Supply and installation of suitable customer specific connectors, junction boxes and cables
- Fluid filling and pressure compensation for underwater use
- Shaft encoders and other electronic devices

## Model 180

Small but robust. Rugged construction ideally suited for smaller oceanographic and ROV winches. Easily modified to include two-pass fiber optic rotary joints.



# Fiber Optic Rotary Joints



We focus on the rotary interface needs of the marine and energy industries. Our fiber optic rotary joints (FORJs) are recognized around the world for innovative performance and reliability in harsh marine environments.

## Model 190

This multi-pass, multimode model has an excellent service track record. The Model 190 can accommodate a variety of fiber types and wavelengths in one unit and its modular design makes it easy to customize for any application.



## Model 197

A rugged, high performance single-pass multimode model with a typical insertion loss of 1.5 dB and capacity for several types of multimode fiber with speeds up to 1000 RPM.



## Model 206

The Model 206 offers the highest performance in a single-pass, singlemode unit. It is also our most robust, single-pass, singlemode assembly. The Model 206 can accommodate bulkhead-mounted receptacles or terminated with connectors.



## Model 215 / 292

Ultra-compact (215 - 0.75 inches / 19 mm Ø; 292 - 0.5 inches / 13 mm Ø), two pass units, the Models 215 and 292 match the high speed and robust characteristics of a single pass model. Designed to meet tight space requirements, these models are well suited to remote I / O applications.



## Experienced Innovators

Our company's reputation for innovation grew when we were the first to develop FORJs for marine applications. Today, we are still recognized as industry leaders. As the developers of the first commercial multi-pass, multimode and singlemode FORJ, as well as a collection of features responsive to the needs of the marine and energy industry, we are continually setting new standards. The Model 291, for example, allows up to 9 passes in a housing less than 2.5 inches (6.4 cm) in diameter. Recent product development also includes a variety of single and multiple channel devices for singlemode applications.

## Outstanding Reliability

We design for demanding conditions. Rigorous testing of every FORJ is performed in our own environmental testing chambers and the facilities of testing specialists. Standard features, such as connectorized interfaces that allow for easy replacement of damaged pigtails, are designed to minimize down time. Our engineers have the resources to design for performance reliability in unique environmental conditions such as subsea depths of more than 18,000 feet (5.5 km), high altitudes for aerospace applications or extreme temperature conditions. We can also design for extra-long life or higher than average speeds.

## Hybrid Units

Our FORJ technology can be combined with electrical slip rings for power and data transmission. Liquid or gas rotary unions can also be integrated to offer designs for all three media in a single assembly.

## Multiplexers

Our line of optical multiplexers completes the FORJ solution – multiplexers encode analog and digital signals for transmission along a single fiber and decode them again for use by the receiving unit.

## Model 228

A single-pass, multimode unit with built in ST connector receptacles, the cost-efficient Model 228 is most suitable for modest life requirements.



## Model 242 / 291

These multi-pass, singlemode FORJs provide high bandwidth transfer of optical signals on up to six (242) or nine (291) separate singlemode optical fibers.



## Model 257

The Model 257 is a compact, two pass, fiber optic rotary joint (FORJ) for plastic optical fiber. Ideally suited to SERCOS applications, the 257 can be combined with our electrical and fluid slip rings, giving a single, compact package for optical signals, electrical power and fluid transfer.



## Model 282

A single-pass, singlemode version of the Model 228, the Model 282 is designed for moderate demands in optical performance and life for applications such as bomb disposal robots.



## Typical Uses

- Remotely operated vehicles
- Oceanographic winches
- Cable reels
- Towed arrays and dipping sonar
- Undersea telemetry
- Robotics

## Options

- Supply and installation of customer specific connectors and fibers
- Customization of mounting configurations, housing materials and drive couplers
- Fluid filling and pressure compensation for underwater use

## Model 285 / 286

Lightweight and compact, the low-cost singlemode Model 285 and multimode Model 286 single-pass models provide high performance and high speed capability to meet the demand for FORJs used in smaller electrical slip rings or installations where space is limited.





# FPSO Swivels

We have designed, manufactured and delivered more than 40 large, complex FPSO swivel assemblies to offshore operators worldwide.



Our custom assemblies allow the continuous delivery of electrical power and signals, hydraulic fluids, and fiber optic signals, with unlimited freedom of the vessel to weathervane about its mooring point. Typically comprised of electrical slip rings, hydraulic utility swivels and fiber optic rotary joints, our swivel assemblies are used in a variety of FPSO systems and are certified for use in hazardous environments. The units within the swivel assemblies can be combined with other products - including electrical slip rings and fiber optic rotary joints – for custom solutions guaranteed to perform in any environment.

## State-Of-The-Art Design

Our engineers have access to a complete parametric, feature-based modeling environment and CAD software for 3D electrostatic analysis. Complex designs can be quickly created with all the necessary digital information in one CAD model. Digital prototyping, comprehensive functional simulation, finite element analysis (FEA) and cross-enterprise collaboration are just some of the capabilities that lead to our efficient use of design time and ultimately to higher quality products.

## Proven Manufacturing Capability

We specialize in custom design, assembly and testing. Virtually all manufacturing tasks are subcontracted to a variety of quality approved vendors. With a full range of boring, turning, milling, drilling and welding equipment, including the latest models of CNC machine tools, our manufacturing partners are well equipped to efficiently handle FPSO swivel machining tasks. Our partner selections are evaluated on a number of quality and capability standards including capacity for large-bore swivel projects, with the ability to maintain tolerances of 0.002 – 0.003 inches (0.050 – 0.076 mm) on diameters up to 118.1 inches (3.0 m).

## Model 250

Typically comprised of electrical slip rings, hydraulic utility swivels and fiber optic rotary joints, the Model 250 swivel permits continuous delivery of critical signals and fluids with an unlimited range of motion.



## Model 284

This hydraulic utility swivel accommodates 2 to 80 separate passes for gases and liquids compatible with 300 series stainless steel and / or Ferralium 255. Well suited to high pressure applications and optional leak detection and collection systems.



## Model 290

First designed to serve as a firewater swivel (FWS) in offshore turret applications, the Model 290 has a hollow bore, is suitable for low speeds and pressures, and is available as single or multipass design with large fluid passages well suited for aqueous media.





# Fluid Rotary Unions



Introduced in the mid 1970's to serve in diver life-support umbilical systems, our fluid rotary unions have been diversified to include a broad range of applications.

Our fluid rotary unions are currently used around the world to ensure reliable transmission of life support, process, power and control fluids. Currently, fluid rotary unions rated for pressures up to 15,000 PSI (1000 bar) are available. 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. Fluid rotary unions can be combined with our electrical slip rings and fiber optic rotary joints.

## Typical Uses

- Marine and life support systems such as saturation diving
- Training centrifuges for pilots and astronauts
- Industrial indexing tables
- Chemical injection systems
- FPSO hydraulic power and control systems
- Semiconductor clean room robotics

## Model 70

This multi-pass model uses separate housings (and seals) per pass to avoid inter pass mixing. It is well suited for low to medium pressure systems. Its standard configuration has up to 11 passes rated for 10 RPM continuous rotation with 1000 PSI of gas applied. A stacked housing design allows easy adaptation to custom configurations.



## Model 136

High pressures, especially when combined with high speeds, represent very demanding operational conditions. The Model 136 is designed with these service conditions in mind. Available in both single and multi-pass versions.



## Model 255

Complementary to the Model 70, Model 255 is a multi-pass fluid rotary union that uses a one-piece housing design. It is well suited for low to medium pressure systems and is offered when its one piece housing offers cost savings, ease of leak recover or other advantages.



# Fiber Optic Multiplexers and Media Converters

Our multiplexers were developed to provide reliable fiber optic transmission of video and data signals in the demanding subsea applications of ROVs, robust defense systems, and other platforms operating in harsh environments around the world.



## Multiplexer Diagnostics Software

This software is available to monitor multiplexer performance from the console end of a system. Optical power, voltage levels, and system configurations can be monitored for both uplink and downlink communications.



## Model 903

This Eurocard-based rack system features redundant fiber options, extensive protection and isolation circuits, and advanced PC-based diagnostics. CWDM and DWDM versions provide system expansion up to 32 video channels, and hundreds of data channels with support for many types of media converters.



## Model 903-HD

This is a high density (HD) Eurocard multiplexer in less than half the volume of the Model 903, suitable for smaller enclosures while supporting most of the 903 features.



## Model 912 OEO

These generic media converters change optical signals to other wavelengths, fiber types, and / or power levels over a wide range of data formats and data rates.



## A Solution for Every Fiber Optic Telemetry Requirement

Our multiplexers use both time division multiplexing (TDM) and wavelength division multiplexing (WDM) to exploit the huge bandwidth of fiber optic cables, combining all video / data signals on to one or two fibers. Advances in coarse wavelength division multiplexing (CWDM) and dense wavelength division multiplexing (DWDM) expand the data carrying capacity of fibers to accommodate the ever-increasing data rates needed for digital video, high resolution sonars and sensors, and high speed networks, such as Ethernet and IEEE-1394 (Firewire). Our modular designs make it easy to reconfigure a system or expand the numbers and types of channels without expensive replacement of umbilicals, tethers or other field cables, as we offer multiple designs / models not just one.

We pioneered industry standard features like embedded diagnostics and automatic fiber switching for ROV systems, and we continue to develop multiplexer cards for newer formats, such as Gigabit Ethernet. Today, with over 1000 systems in the field, we offer a full range of proven, off-the-shelf multiplexer cards as well as custom cards for special channel configurations, emerging interface standards, and high reliability applications. Stand-alone media converters are also available for various Ethernet, digital video, and other multi-gigabit serial channels.

## Custom Solutions

Our advanced CAD systems enable rapid development of new interfaces and packages to suit diverse applications. With more than 100 different types of printed circuit boards developed in the last five years, we have established an experienced team of designers with expertise in software, firmware, high-speed digital and analog interfaces and fiber optics. Existing custom systems support high shock and vibration environments, long life requirements of more than 200,000 hours and long data links over 100 km of fiber. Moreover, our experience with the detailed design of fiber optic transmitters and receivers provides a level of optimization and performance that is not achievable with commercial devices.

### Model 907

This single board multiplexer provides 3 video and 6 data channels in a PC / 104 form factor card. A full line of expansion cards supports a wide range of signals in a compact, low power package. Media converters are also available in this format as stand-alone units or integrated CWDM modules.



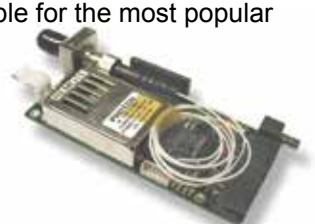
### Model 907V

This version of the 907 provides 6 video channels with support for the same stacking expansion cards used by the standard 907.



### Model 914

This economical single board multiplexer supports 1 video and 4 - 6 data channels in an extremely small package. Expansion cards are available for the most popular interfaces, such as Ethernet.

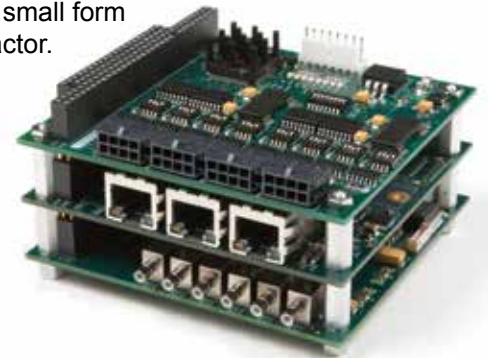


## Features

- Support for broadcast quality video in composite (NTSC / PAL), Y / C (S-video), RGB, and YPrPb formats
- Support for digital video through SDI, HD-SDI (HDTV), and IEEE-1394
- Support for many serial data, network, and bus protocols, including TTL, RS-232, RS-485 / 422, Ethernet, CANBus, ARCNET, Profibus, IEEE-1394, USB, ECL / PECL, and various sonars
- Support for many analog signal formats, including audio, hydrophones, and various sensors
- Modular system for easy reconfiguration with up to 32 video channels and 256 data channels per system
- Low latency data transmission for time-critical control, e.g. force-feedback robotic manipulators
- Embedded diagnostics including LED indicators and PC based diagnostics via a serial port
- Pressure tolerant versions available

## Custom Solutions

907 motherboards and expansion card can stack to form a custom multiplexer solution while maintaining a small form factor.





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