# Fiber Optic Rotary Joints

*Product Guide*

**A complete product line of fiber optic rotary solutions for the most demanding applications.**

- Robotics
- Vehicle Turrets
- Radar Antennas
- Medical Systems
- Security Systems
- Sensor Platforms
- Material Handling Systems
- Remotely Operated Vehicles
- Fiber Optic Cable Reels
- Video Surveillance Systems
- Marine Propulsion Systems
- Wind Energy Turbines

MOOG
COMPONENTS GROUP

# Fiber Optic Rotary Joints

## Comprehensive Product Range

**Fiber Optic Rotary Joints** (FORJs) are to optical signals what electrical slip rings are to electrical signals, a means to pass signals across rotating interfaces, particularly when transmitting large amounts of data. FORJs maintain the intrinsic advantages of fiber end to end. Moog Components Group has been producing Fiber Optic Rotary Joints for over twenty-five years.

### *Single or Multi-channel*

FORJs are available in single and multi-channel options. The most cost and size efficient options are the single and dual channel designs. If more than two fibers are present in a system, multiplexing solutions are available to combine multiple channels onto one or two fibers to allow the use of a one or two channel FORJ.

In cases where more than two fibers are required, Moog has several designs; FO190, FO242, and FO291 where single channels are stacked to achieve the desired number of channels. The FO300 uses a common de-rotating optical element for all fiber channels.

### *Singlemode or Multimode*

Singlemode fibers allow the propagation of a singlemode of optical energy due to their small core size and small numerical aperture and for this reason they exhibit very high bandwidths. Most singlemode fiber systems operate at 1300 nm and 1550 nm wavelengths because of lower fiber attenuation at these wavelengths. Because of these smaller core sizes and numerical aperture, singlemode FORJs must be designed with very precise mechanical alignments.

Multimode fibers have large cores and large numerical apertures allowing the propagation of multiple modes of optical energy. These features allow larger amounts of light to be transmitted from sources such as LEDs and VCSELs, but result in higher attenuation and dispersion. Because of these attenuation and dispersion features, multimode fiber systems are typically used for shorter datacom links. Most multimode systems operate at 850 nm and 1300 nm.

### *Size*

Physical constraints are important in the selection of a FORJ. The FORJ Specification Data table shows product dimensions. Drawings for each product can be found in our product documentation. In addition to the on-axis models, we also have a through-bore FORJ design available for off-axis systems.

### *Fiber Optic Rotary Joint Features*

- Ruggedized for harsh environments
- Compact sizes
- Variety of configuration options
- Custom designs available

### *Protocols*

All FORJs listed in this brochure are passive devices that will work with any optical protocol suitable for the type of optical fiber used. Our FORJs operate with the following data protocols:

- SERCOS™
- Ethernet (10 / 100 / 1000)
- CANBUS™
- SDI
- TTL Serial Data
- PROFIBUS
- ECL
- IRIG-B
- Tritech ARCNET
- IEEE-1394
- INTERBUS-S
- MIL-STD-1553
- HD-SDI (HDTV)
- MS-900 / 97
- RS-232 / RS-485 / RS-422
- SERDES Protocols (e.g. TAXI, HotLink, GLINK)
- OC-48 (2.5 Gbps) and OC-192 (10 Gbps)
- SONET Protocols and 10 GB Ethernet

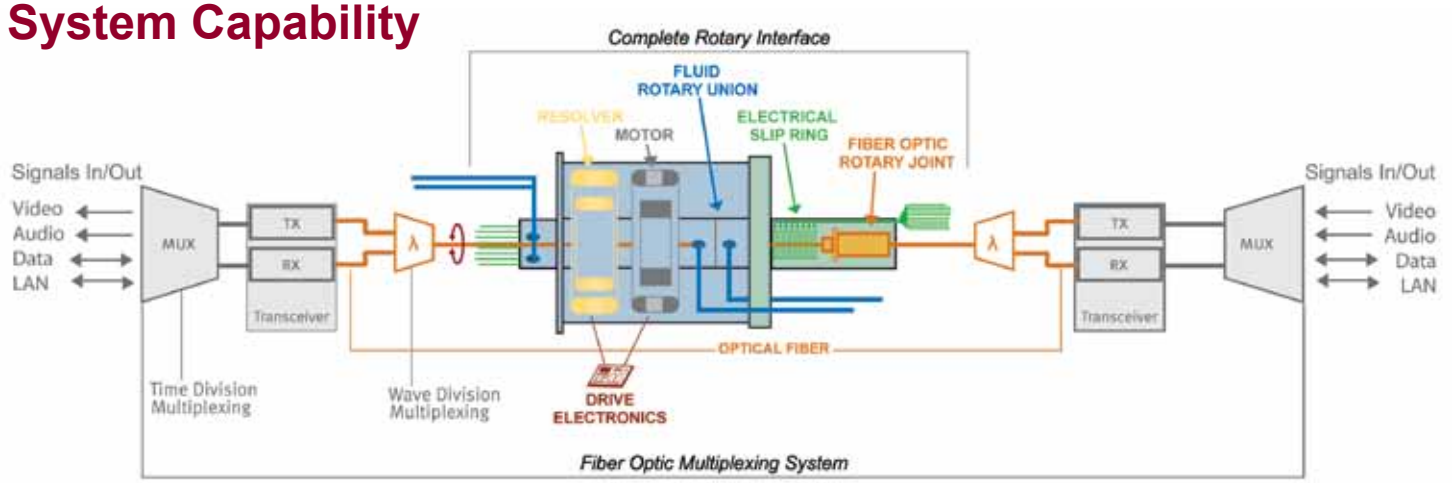
### *Outstanding Reliability*

Our FORJs are designed for the most demanding conditions and are tested to rigorous environmental and performance standards. All materials and components have been selected to ensure the highest reliability in extreme environments, including shock and vibration, temperature, humidity and dust. These FORJ designs have proven performance records in both industrial and military applications with these environmental conditions.

### *FORJ Models*

| | Singlemode | | | Multimode | | |
|---|---|---|---|---|---|---|
| **Multi-Channel** | FO242  | | | FO190  | | |
| | FO291  | FO300  Single and Multimode | | FO215 / FO292 / FO257  | | |
| **Single Channel** | FO206  | FO282  | FO285  | FO228  | FO286  | FO197  |

## System Capability




### *Complete Rotary Interface*

Typically, fiber optic rotary joints are part of a more comprehensive rotary interface; in addition to the fiber passes there are electrical power and signal channels. As the largest slip ring supplier in the world, Moog Components Group is able to select the appropriate slip ring to integrate with any of the FORJs shown. A number of these integrated slip ring / FORJ assemblies are shown below.

H18 / 24 with Integral FORJ

FO292R Right Angle

FO257 Standalone and with Industrial Slip Ring

FO176 / 242 Hybrid

Moog Components Group is also able to integrate fluid rotary unions to allow the transfer of liquid or gas across the rotary interface. This includes both low pressure fluid lines such as would be used for a coolant or high pressure hydraulic lines. It is also common to incorporate other rotary components, such as resolvers, encoders, motors and actuators into advanced rotary interface assemblies.

These rotary interface solutions can be provided to meet unique environmental requirements from deep space to 5500 meters below the ocean surface. The integration of FORJs into more complete rotary interface assemblies allows optimum performance at the lowest cost to the customer.

**Combined Rotary Interface**

*Coal Stacker / Reclaimer hybrid slip ring with 800 amps circuits for conveyor motors plus signal circuits, position encoder and two pass Model FO190 fiber optic rotary joint for voice communications and PLC data.*

### *Fiber Optic Multiplexing*

To exploit the full bandwidth of fiber, multiplexing combines many signals of various types — video, serial data, network data, control lines — onto one optical fiber. Multiplexers that combine a number of signals electrically are typically called time division multiplexers (TDM); discrete parts of each input signal are assigned a time slot in the outgoing data stream. Moog Components Group has a wide range of TDM options that allow multiple electrical channels to be multiplexed onto one or more optical fibers.

We also produce multiplexers that combine a number of optical signals onto one or two fibers. These multiplexers use wave division multiplexers (WDM) because they transmit different signals on different wavelengths of light on the same optical fiber.

907

914

Both multiplexing techniques can be used separately or together to simplify optical transmission systems and reduce cost, improve reliability, reduce weight and improve performance. Multiplexed systems also simplify system upgrades since numbers of channels and channel bandwidth is a function of the electronics rather than the transmission line or components. Moog Components Group multiplexers accommodate the ever-increasing data rates needed for digital video and industrial data protocols, as well as high speed networks such as Ethernet and IEEE-1394 (Firewire).

**Multiplexer System**

*The 914 multiplexer unit combines with a FO286 fiber optic rotary joint to provide for the simultaneous transmission of a variety of signals over a single fiber through a rotating interface. This compact turnkey solution is used in a wind turbine application.*

# FORJ SPECIFICATION DATA

| | Performance | | | | | Physical | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Model Number** | **Fiber** | **Channels** | **Maximum Insertion Loss** | **Maximum Rotational Speed** | **Operating Temperature** | **Length in. (mm) [1]** | **Flange Diameter in. (mm)** | **Drum Diameter in. (mm)** | **Interface [2]** | **Connector Type** |
| **FO190** [3] | MM [4] | 2 to 21 | 5.5 dB | 100 rpm | -40° C to +60° C | See data sheet | 5.02 (127.5) | See data sheet | Adaptor | FC / PC or ST |
| **FO197** [3] | MM | 1 | 3.0 dB | 1,000 rpm | -40° C to +60° C | 2.38 (60.6) | 1.50 (38.1) | 0.62 (15.9) | Adaptor or Pigtail | FC / PC or ST |
| **FO206** [3] | SM | 1 | 3.5 dB | 1,000 rpm | -40° C to +60° C | 3.06 (77.7) | 1.50 (38.1) | 0.77 (19.6) | Adaptor or Pigtail | FC / PC, FC / APC or ST |
| **FO215** [3] | MM | 2 | 5.5 dB | 500 rpm | -40° C to +60° C | 3.25 (82.5) [5] | 1.50 (38.1) [5] | 0.75 (19.1) [5] | Adaptor or Pigtail | FC / PC or ST |
| **FO228** | MM | 1 | 4.0 | 100 rpm | -40° to +75° C | 1.25 (31.1) | 1.50 (38.1) | .062 (15.9) | Adaptor | FC / PC or ST |
| **FO242** [3] | SM [4] | 2 to 5 | See data sheet | 100 rpm | -40° C to +60° C | See data sheet | 5.02 (127.5) | See data sheet | Adaptor | FC / PC or ST |
| **FO257** | POF | 2 | 8.0 dB [6] | 500 rpm | -40° C to +60° C | 3.47 (88.1) | 1.85 (47.0) | 1.24 (31.5) | Pigtail | As required |
| **FO282** | SM | 1 | 4.0 dB | 100 rpm | -40° to +75° C | 1.25 (31.6) | 1.50 (38.1) | 0.62 (15.9) | Adaptor | FC / PC or ST |
| **FO285** [3] | SM | 1 | 3.5 dB | 1,000 rpm | -55° C to +75° C | 0.68 (17.0) | .075 (19.1) | .037 (9.5) | Pigtail | As required |
| **FO286** [3] | MM | 1 | 2.5 dB | 1,000 rpm | -55° C to +75° C | 0.43 (11.0) | 0.75 (19.1) | 0.37 (9.5) | Pigtail | As required |
| **FO291** [3] | SM [4] | 2 to 9 | See data sheet | 100 rpm | -40° C to +60° C | See data sheet | See data sheet | See data sheet | Adapter | FC / PC or ST |
| **FO292** | MM | 2 | 6.0 dB | 500 rpm | -40° C to +60° C | 2.25 (57.2) | 1.25 (31.8) | 0.50 (12.7) | Pigtail | As required |
| **FO300A** | SM / MM | 2 to 19 | 4.0 dB / 4.0 dB | 100 rpm | -20° C to +60° C | 4.22 (107.2) [7] | 2.35 (60.0) [7] | 2.35 (60.0) [7] | Pigtail | As required |
| **FO300B** | SM / MM | 2 to 31 | 4.5 dB / 6.0 dB | 100 rpm | -20° C to +60° C | 5.76 (146.2) [7] | 2.27 (69.1) [7] | 2.27 (69.1) [7] | Pigtail | As required |

| **Hybrid Units** | |
|---|---|
| **H18** | FO285, FO286 only |
| **H24** | FO285, FO286 only |
| **176** | All FO models |
| **180** | All FO models apart from FO190, FO242 and FO300B |

[1] Distance from mounting surface of flange to end of body adaptor interface (unless not available). See data sheets for mounting options

[2] Pigtail lengths for FORJs with pigtail interfaces is as required

[3] Available in a pressure-compensated version (see data sheet for dimensions)

[4] FO190 can be combined with and FO242 or FO291 to offer a hybrid multimode and singlemode solution

[5] Dimensions are for the pigtail interface

[6] Insertion loss is highly dependent on the pigtail length

[7] See data sheet for FO300 mounting options

Note: Optical values for all listed multimode FORJs are based on use with LED sources.

## *Shock and Vibration*

Moog Component Group FORJs support high shock and vibration environments, long life requirements of more than 200,000 hours and long data links over 100 km of fiber. Units are available that are tested to MIL-STD-167-1, MIL-STD-202, MIL-STD-204 for vibration and MIL-STD-810D/E/F and MIL-STD-901D for shock.

## *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

Specifications and information are subject to change without prior notice.

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