

## Fiber Optic Rotary Joints

### Description

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 20 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 three 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.

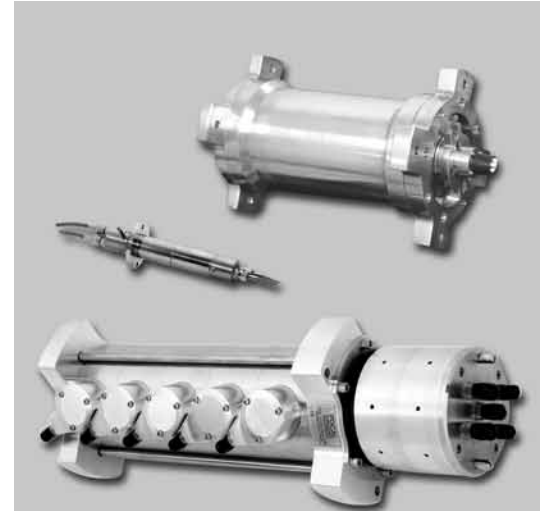
### Singlemode or Multimode

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.

### Features

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



### Typical 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

# Fiber Optic Rotary Joints (FORJ)

## FORJ Performance Data

Product	Performance							Physical					
	Fiber Type		Channels	Insertion Loss - Maximum dB MM = 5.5 dB		Maximum Rotational Speed	Operating Temperature	Size Inches (mm)			Standard Interface		
-	SM	MM	-	SM	MM	RPM	-	Minimum Length	Flange Diameter	Drum Diameter	Pigtail / Adaptor	Connector Type	Pigtail Length
FO228	N	Y	1	NA	4.0	100	-40 to +75°C	1.75 (44.45)	1.50 (38.10)	0.73 (18.54)	Adaptor	FC or ST	NA
FO197	N	Y	1	NA	3	1000	-40 to +60°C	2.38 (60.45)	1.50 (38.10)	0.62 (15.74)	Pigtail or Adaptor	FC, ST for Adaptors; As Required on Pigtails	As Required
FO206	Y	Y	1	3.5	NA	1000	-40 to +60°C	2.36 (59.94)	1.50 (38.10)	0.77 (19.55)	Pigtail or Adaptor	FC / PC Standard Alternates Available	As Required
FO285 *	Y	Y	1	3.5	NA	500 +	-55 to +75°C	1.02 (25.90)	0.75 (19.05)	0.037 (.93)	Pigtail	As Required	As Required
FO286 *	N	Y	1	NA	2.5	500 +	-55 to +75°C	0.75 (19.05)	0.75 (19.05)	0.037 (.93)	Pigtail	As Required	As Required
FO310	Y	Y	1	1.5	1.5	100	-40 to +85°C	3.41 (86.6)	1.5 (38.1)	0.63 (15.9)	Pigtail	As Required	As Required
FO300A **	Y	Y	2 to 17	< 4.0 dB	< 4.0 dB	100	-40 to +60°C	4.22 (107.18)	1.8 (45.72)	2.35 (59.69)	Pigtail	As Required	As Required
FO300B **	Y	Y	2 to 31	< 4.5 dB	< 5.0 dB	100	-40 to +60°C	5.76 (146.2)	2.1 (53.34)	2.72 (69.1)	Pigtail	As Required	As Required
FO300C **	Y	N	2 to 52	< 5.0 dB	NA	100	-40 to +60°C	6.79 (172.5)	3.1 (78.74)	3.72 (94.5)	Pigtail	As Required	As Required
FO215 *	N	Y	2	NA	5.5	500 +	-40 to +60°C	P: 3.30 (83.82)	P: 1.50 (38.10)	P: 0.75 (19.05)	Pigtail or Adaptor	ST, FC, SC, LC	As Required
FO257	Plastic		2	8 ***		500 +	-40 to +60°C	3.47 (88.13)	1.85 (46.99)	1.24 (31.49)	Pigtail	ST or SMA	As Required
FO292 *	N	Y	2	NA	5.5	500 +	-40 to +60°C	2.25 (57.15)	1.25 (31.75)	0.50 (12.7)	Pigtail	ST, FC, SC, LC	As Required
FO242 *	Y	N	2 to 5	5.5	NA	100 +	-40 to +60°C	See Data Sheet	5.02 (127.50)	5.00 (127.00)	Adaptor	FC / PC Standard; ST Optional	NA
FO291 ***	Y	Y	2 to 9	6	5.5	100 +	-40 to +60°C	See Data Sheet	See Data Sheet	See Data Sheet	Adaptor	FC / PC Standard; ST Optional	NA
FO190 *	N	Y	2 to 21**	NA	5.5	100	-40 to +60°C	See Data Sheet	5.02 (127.50)	5.00 (127.0)	Adaptor	FC / PC, ST	NA
<b>Hybrid Units</b>													
H18	Y	Y	1 Optic 18 Elec.	3.5	2.5	500	-20 to +60°C	3.4 (86.36) MM, 3.64 (92.45) SM	1.75 (44.45)	0.87 (22.0)	Pigtail	As Required	As Required
H24	Y	Y	1 Optic 24 Elec.	3.5	2.5	500	-20 to +60°C	3.7 (93.98) MM, 3.94 (100.07) SM	1.75 (44.45)	0.87 (22.0)	Pigtail	As Required	As Required

\* The FO242 and FO190 can be combined to offer a hybrid multimode and singlemode solution  
 SM = Singlemode MM = Multimode  
 \*\* More passes are available with a custom design  
 \*\*\* 1 MM pass can be accommodated on the FO291

\* Right angle options available  
 \*\* Consult factory for number of passes available for SM and MM combination applications  
 \*\*\* Pigtail length effect with plastic fiber

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 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

## FO292

### *Fiber optic rotary joint*

#### **Description**

The FO292 is an ultra-compact, two pass, multimode fiber optic rotary joint (FORJ). It is passive and bidirectional, and allows the transfer of optical signals on two separate optical fibers across rotational interfaces.

The FO292 can be combined with our electrical and fluid slip rings, giving a single, compact package for optical signals, electrical power and fluid transfer.

The FORJ can be assembled with pigtail lengths tailored to the customer's application. Housing, mounting flange and drive features can also be customized to meet the customer's requirements. The FO292 can also be installed with one or both ends having a 90° cable exit, providing even more flexibility when installing the unit into existing slip ring assemblies or installations with little clearance space.

#### **Features**

- Provides rotary coupling for two multimode fibers
- Passive and bidirectional
- Can be combined with various electrical slip rings and fluid unions
- Smaller and more compact than the standard FO215 with improved back reflection performance
- Customized mounting flanges available
- Optional 90 degree cable exits at either end of the FORJ
- Optional fluid-filled version for deep submergence to 10,000 psi (69,000 kPa)
- Can be integrated into existing slip ring designs
- Stainless steel housing
- Rugged design
  - MIL-STD-167-1 ship vibration
  - MIL-STD-810E functional shock (40 g)



#### **Typical Applications**

- Winches and cable reels for remotely operated vehicles
- Remote I / O in industrial machinery
- Video surveillance systems
- Material handling systems
- Sensor platforms
- Robots
- Turrets

# Fiber Optic Rotary Joints (FORJ)

## FO292 Specifications

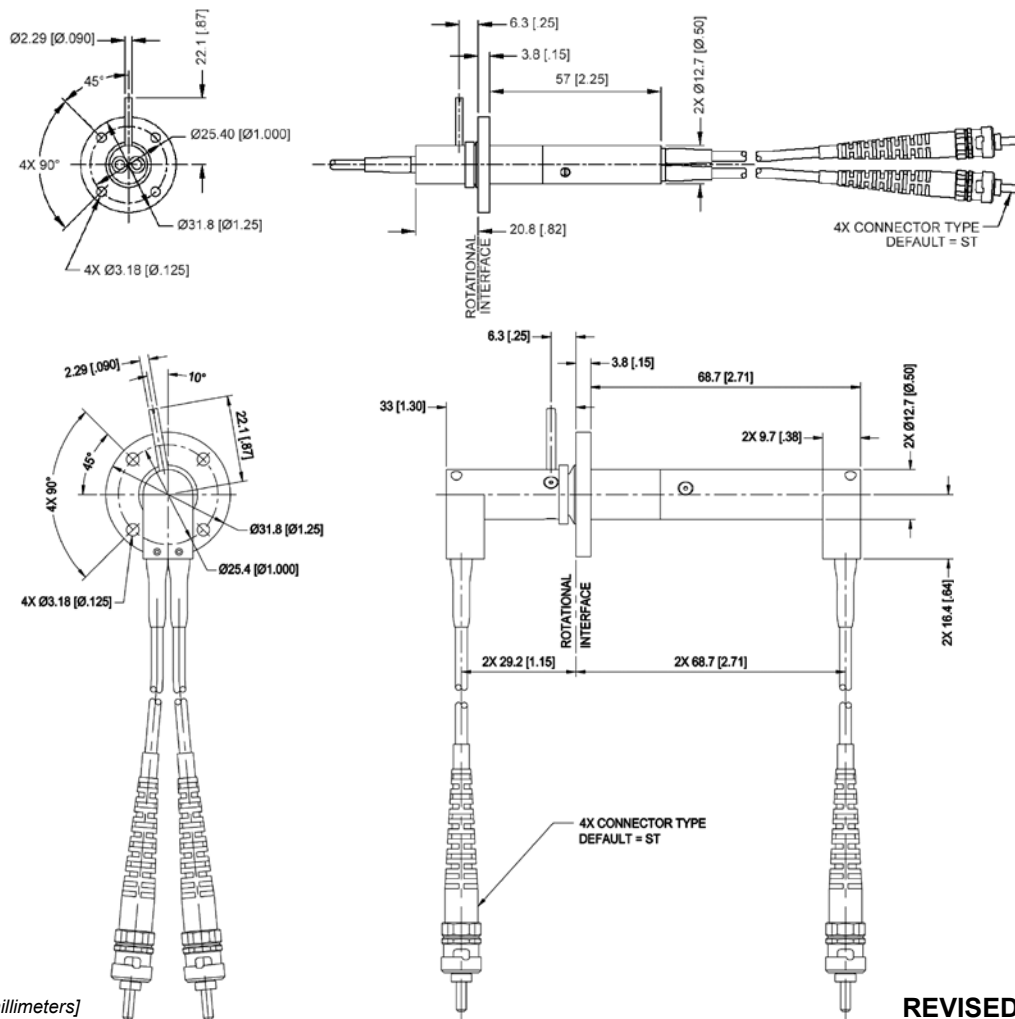
Fiber Size (Microns)	50 / 125 or 62.5 / 125. Consult factory for other fiber types.		
Insertion Loss*		Typical	Maximum
	Channel 1	< 1.5 dB	< 3.0 dB
	Channel 2	< 4.5 dB	< 6.0 dB
Rotation Variation	Typical < 0.5 dB		Maximum < 1.0 dB
Back Reflection	Typical 20 dB		18 dB Minimum
Wavelengths	850, 1300 or 1550 nm. Consult factory for other multi-wavelength applications.		
Rotational Speeds	To 500 rpm. Higher rotational speeds should be discussed with the factory.		
Temperature	-40 to +60 deg C (dry version) -20 to +60 deg C (wet version) Consult factory for extended range.		
Dispersion	< 10 ps (calculated)		
Exterior Surfaces	Stainless steel		
Vibration	Tested to MIL-STD-167-1 (ships)		
Shock	Tested to MIL-STD-810F		
Terminations	Standard is with pigtail cables terminated with ST connectors at each end. Alternative connectors types available (FC, SC, LC).		
Pressure	Up to 10000 psi (69,000 kPa) for fluid filled version**		
Pigtail Length*	As required		

\* Add 0.5 dB to the insertion loss to version with 90 degree cable exits.

\*\* Fluid filled version is slightly larger than shown below.

**Note:** Optical values given are based on use with LED sources.

## FO292 Dimensions



Dimensions in inches [millimeters]

REVISED 12/2013