

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.

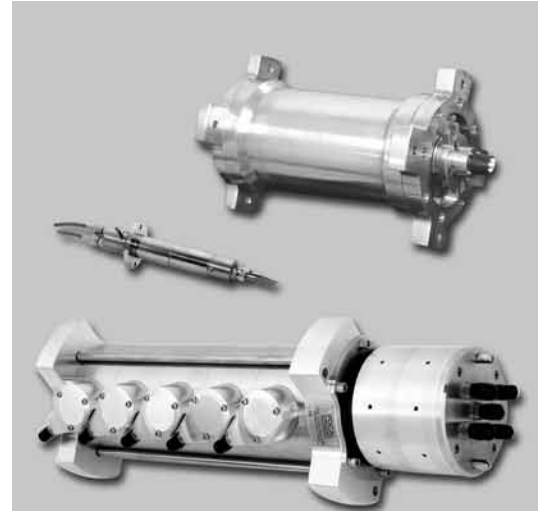
Singlemode or Multimode

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
Hybrid Units													
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

FO291

Fiber optic rotary joint

Description

The FO291 is a multi-pass, singlemode fiber optic rotary joint (FORJ). It is passive and bidirectional, and allows the transfer of optical signals across a rotational interface on 2 to 9 separate singlemode optical fibers.

The FO291 can be combined with our electrical and / or fluid slip rings, giving a single, compact package for optical signals, electrical power and fluid transfer, with ISO 9000 quality.

Other options include fluid-filling for pressure compensation permitting operation at any ocean depth, and the combination of the FO190 to include up to 19 multimode passes.

Features

- 2 to 9 single mode channels
- Can be combined with our electrical slip rings, fluid rotary unions and the FO190 multimode fiber optic rotary joint
- Alternative drive coupling arrangements are available (consult factory for specification details)
- Tested to 10,000 psi (69,000 kPa) when fluid-filled
- Aluminum and stainless steel construction
- Connectorized interfaces, for easy fiber cable replacement
- Rugged design
 - MIL-STD-167-1 ship vibration
 - MIL-STD-810F functional shock (40g)



Typical Applications

- Remotely operated vehicles
- Floating production systems
- Undersea telemetry
- Seismic streamers
- Radar antennas
- Cable reels

Fiber Optic Rotary Joints (FORJ)

FO291 Specifications										
Fiber Size (Microns)	9 / 125 SMF-28									
Insertion Loss (dB)* (Typical / Maximum) Includes Rotation Variation	Channel	2-Pass	3-Pass	4-Pass	5-Pass	6-Pass	7-Pass	8-Pass	9-Pass	
	1	2.0/3.0	2.0/3.0	2.0/3.0	2.0/3.0	2.0/3.0	2.0/3.0	2.0/3.0	2.0/3.0	2.0/3.0
	2	2.0/3.5	2.5/3.5	2.5/3.5	2.5/3.5	2.5/3.5	2.5/3.5	2.5/3.5	2.5/3.5	2.5/3.5
	3		2.5/4.0	3.0/4.0	3.0/4.0	3.0/4.0	3.0/4.0	3.0/4.0	3.0/4.0	3.0/4.0
	4			3.0/5.0	3.5/5.0	3.5/5.0	3.5/5.0	3.5/5.0	3.5/5.0	3.5/5.0
	5				3.5/5.5	4.0/5.5	4.0/5.5	4.0/5.5	4.0/5.5	4.0/5.5
	6					4.5/6.5	5.0/6.5	5.0/6.5	5.0/6.5	5.0/6.5
	7						5.5/6.5	5.5/6.5	5.5/6.5	5.5/6.5
	8							6.0/6.5	6.0/6.5	6.0/6.5
	9									6.0/6.5
Rotation Variation	Typical < 1.0 dB, maximum < 2.0 dB									
Back Reflection**	Typical > 22 dB, minimum > 18 dB									
Wavelengths	1310 / 1550 nm. Consult factory for other wavelengths									
Rotational Speeds	To 100 rpm dry and 60 rpm fluid filled. Consult factory for higher rotational speeds									
Temperature	-40 to +60 deg C standard. Consult factory for extended range									
Dispersion	< 50 fs / nm (calculated)									
Exterior Surfaces	Stainless steel and aluminum									
Vibration	Tested to MIL-STD-167-1 (Ships)									
Shock	Tested to MIL-STD-810F									
Connectors	FC / PC connector bushings standard (ST connector bushings optional)									
Pressure	Up to 10,000 psi (69,000 kPa) for fluid filled version									
Pigtail Length	FORJ is connectorized with FC / PC, ST optional. Pigtail length and connector type optional									

*Insertion loss values include fiber cables attached at both ends of a connectorized FORJ.

**Lower back reflection available, consult factory.

Variation Table	
No. Passes	"L" Length
2	3.82 (97)
3	4.70 (119)
4	5.59 (142)
5	6.47 (164)
6	7.36 (187)
7	8.24 (209)
8	9.13 (232)
9	10.01 (254)

FO291 Dimensions

