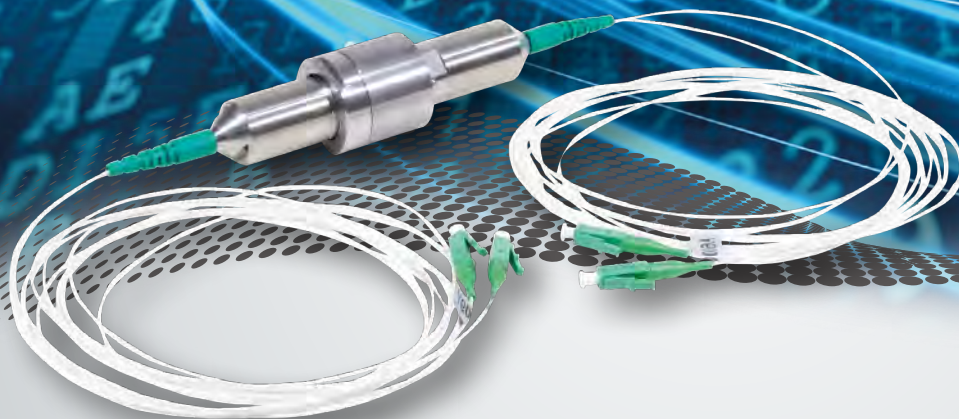


SPINNER Rotating Solutions



Fiber Optic Rotary Joints

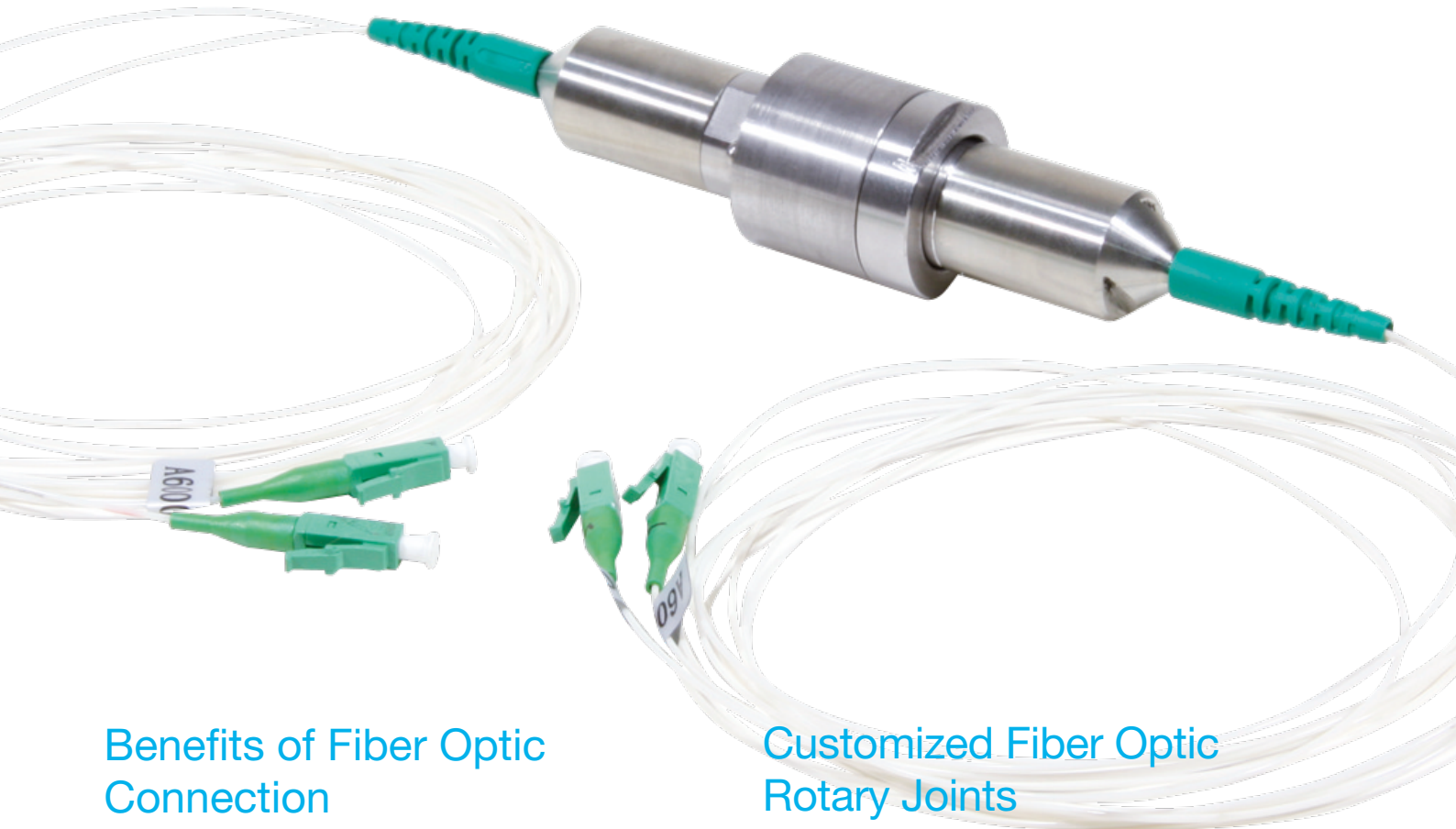
Edition C/2016

HIGH FREQUENCY PERFORMANCE WORLDWIDE
www.spinner-group.com



SPINNER is one of the leading manufacturers for high performance rotary joints worldwide. In particular fiber optic rotary joints require a high quality optical and mechanical fabrication environment. This qualifies SPINNER as integral supplier for fiber optic rotary joints. We provide the precision mechanics and all the optical parts from a single source.

Beyond this, SPINNER can offer combinations of fiber optic rotary joints together with RF rotary joints, non-contacting power transmission modules, slip rings, media joints or non-contacting data transmission. In particular, SPINNER focuses on the combination of data and power transmission solutions with small form factor.



Benefits of Fiber Optic Connection

Digital Data Transmission:

- Up to 40 Gbit/s per channel
- Wavelength Division multi-plexing (WDM) allows transmission of multiple data channels over one fiber optic link
- High-grade configurability

Analogue Signal Transmission:

- High sensitivity
- Short-haul systems

Fiber Optic Sensors:

- Robust sensors in a widespread field of applications
EMI free signal transmission
- Optical fiber technology offers an excellent solution to overcome EMI problems

Customized Fiber Optic Rotary Joints

The SPINNER FORJ Portfolio allows flexible adoption to your requirements such as:

- Special fibers
- Extended fiber length
- Up to 52 channels
- Extended wavelength range
- Particular labeling
- Adapted flange concept
- Mixed fibermode assembly, e.g. multi-mode and single-mode fiber, in multi-channel FORJ
- Customized insertion loss values
- Insertion loss bands over different channels
- Special outgoing goods inspections with measurement of specific parameters

Feel free to configure your product with the according order numbering nomenclature for single-channel FORJ on page 6 and multi-channel FORJ on page 9. Please let us know your requirements beyond!

Fiber Optic Core Features

Optical Performance Parameter

- Low insertion loss
- High return loss values
- Low variation over rotation

Optical Parameter Tracking over Rotation

- Narrow insertion loss band across all channels of a multi-channel fiber optic rotary joint

Fiber Type

- Single-mode E9/125 μm
- Multi-mode G50/125 μm (also G62.5/125 μm)
- Specialized fibers possible e.g. for high temperature application or large core fibers

Environmental Conditions

- IP code protection for harsh environmental applications
- High temperature capability for implementation in RF systems
- Hydrostatic pressure capability for deep-sea applications

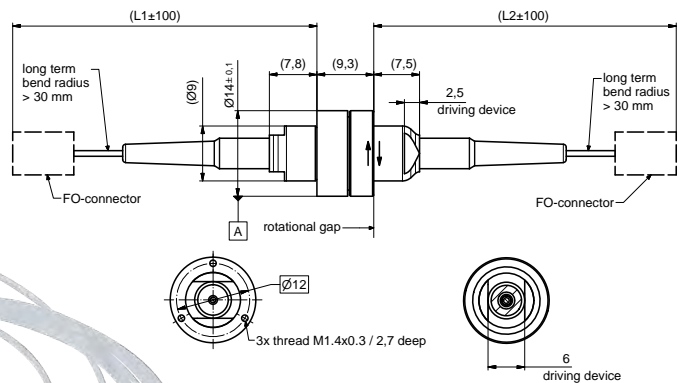
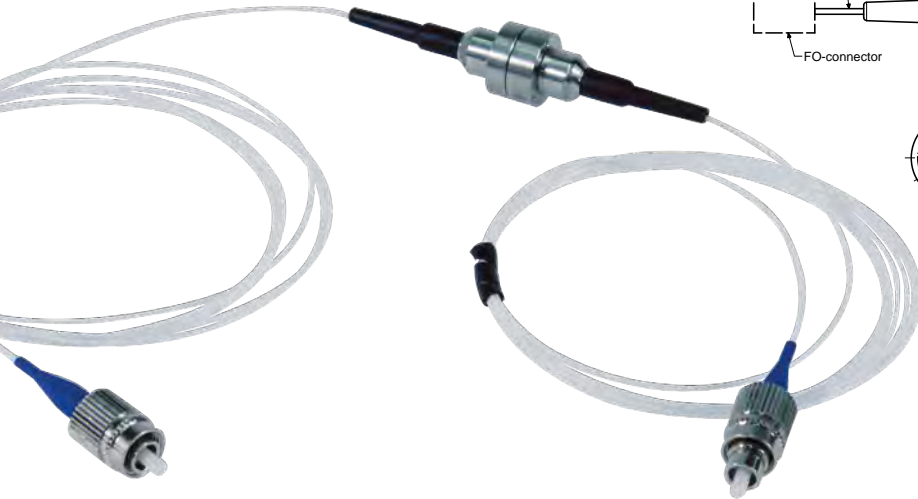
Connector type	Polish	Single-Mode	Multi-Mode	Comment
FC	PC/UPC/APC	x	x	standard
SC	PC/UPC/APC	x	x	
ST	PC/UPC	x	x	
LC	PC/UPC/APC	x	x	standard
LSA	PC/UPC/APC	x	x	
LuxCis	PC/UPC/APC	X	x	harsh environment
Molex/LC	PC/APC	x	x	harsh environment
Stratos S900	n/a	x	x	Expanded Beam
Pro Beam	n/a	x	x	Expanded Beam

All Fiber Optic Components are Manufactured in Clean Room Environment ISO Class 7

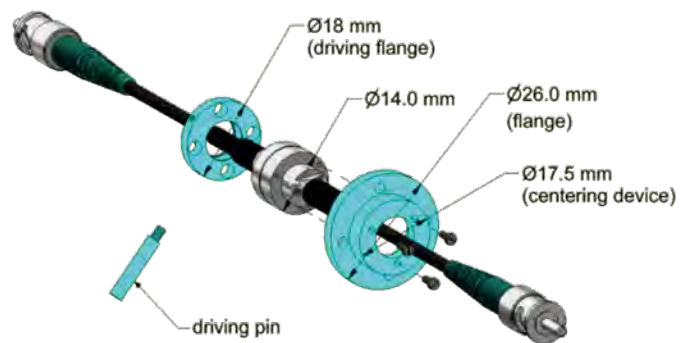


SPINNER FORJ Single-Channel

SPINNER FORJ 1.14



The SPINNER FORJ 1.14 demonstrates highest performance at most compact dimensions in SPINNER's single-channel family. A superior design allows typical insertion loss values below 1.0 dB with single-mode fibers. The compact dimensions of this design combined with a low weight of 18 g enables rotation speeds of 10000 rpm and beyond. The SPINNER FLEXIFLANGE allows easy adaptation of this rotary joint to your missions!



SPINNER FLEXIFLANGE allows easy adaption of single-channel FORJs to your application. Just let us know your flange requirements!

SPINNER FORJ Single-Channel Specification for Single-Mode (SM) and Multi-Mode (MM) Fiber

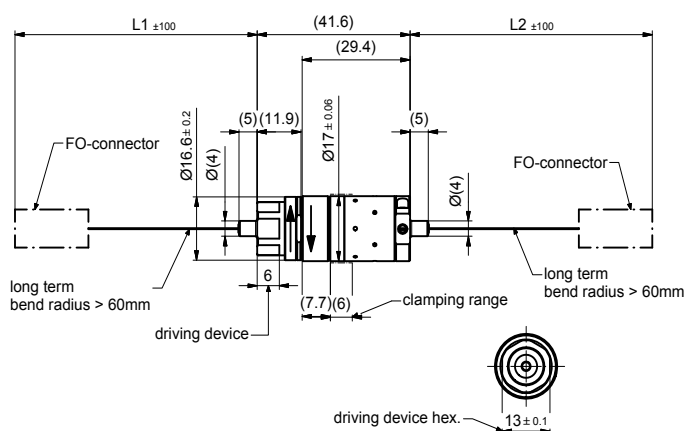
SPINNER FORJ	1.14	1.17/ 1.17pc*)	1.22
Insertion Loss max.	1.0 dB (SM)	1.5 dB (SM) / 2.5 dB (MM)	2.0 dB (SM) / 3.0 dB (MM)
Insertion Loss variation over rotation max.	0.5 dB	1.0 dB	1.0 dB
Return Loss max.	50 dB (SM) **)	50 dB (SM) **)	50 dB (SM) **)
Wavelength	1310 nm / 1550 nm (SM) or 850 nm / 1300 nm (MM)		
Rotation speed	3000 rpm	60 rpm	1000 rpm
Weight (excl. connectors)	18 g	60 g	130 g
Torque	0.06 Nm	0.3 Nm	0.3 Nm
Degree of protection	IP54	IP68 *) , seawater resistant	IP65
Recommended temperature range	-40 °C to +85 °C (Buffered Fiber) / -40 °C to +71 °C (Protective Tube)		

*) 1.17pc, IP 68 up to 4500m operational depth

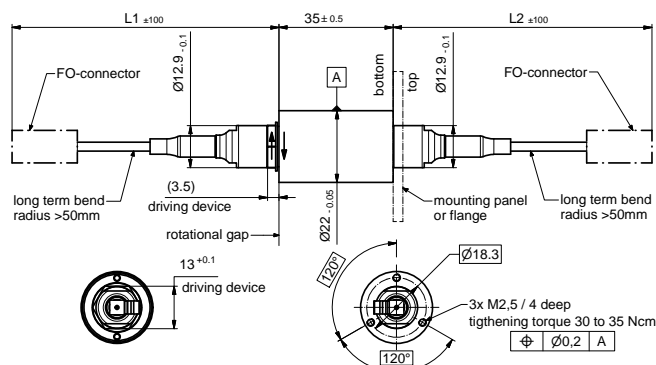
**) not applicable for MM

SPINNER FORJ 1.17 / 1.17pc

The SPINNER FORJ 1.17 is designed for roughest environments and can withstand highest vibration and shock requirements as well as humidity combined with seawater. This design is derived from the needs of offshore and under water vehicle industries and IP 68 rated. As special feature we provide this single-channel rotary with pressure compensation for your deep sea applications down to 4.500 m as SPINNER FORJ 1.17pc.

**SPINNER FORJ 1.22**

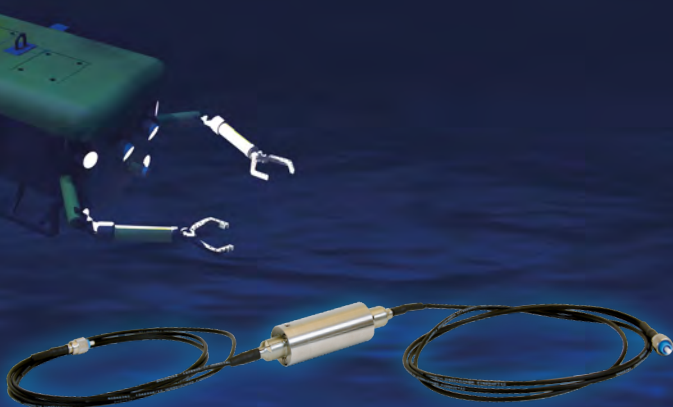
For rough environments in industrial applications SPINNER FORJ 1.22 is protected with IP 65 against dust and humidity. The protective fiber tubing safes fibers during handing in the assembly process.



Feel Free to Configure your SPINNER FORJ Single-Channel with the Ordering Number Nomenclature :

Rotary Joint	Fiber Optic	Channel Count		Housing Type	Fiber Type		Connectors	Polish		Length L1	Length L2		Extra Feature	Customer Specific UID
R	O	01	-	X	Z	-	XX	Z	-	XX	ZZ	-	X	XX
				E			Any of below listed combinations possible. Please note different polish types for Single-Mode and Multi-Mode fibers. In case of Stratos S900, blank for polish.							
Ø 22 mm (I-Type) IP65				F										
Ø 17 mm (I-Type) IP68				G										
Ø 14 mm (I-Type) IP54														
Single-Mode E9 / 125					S									
Multi-Mode G50 / 125					M									
Multi-Mode G62.5 / 125					N									
Connector Type				Polish Multi-Mode	Polish Single-Mode									
FC				PC	UPC, APC, PC		FC							
SC				PC	APC, PC		SC							
ST				PC	PC		ST							
LC				PC	UPC, PC		LC							
LSA				PC	UPC, PC		LS							
LuxCis				PC	APC, PC		LX							
Molex/LC				PC	PC		ML							
Stratos S900				N/A	N/A		S9							
PC								P						
APC								A						
UPC								U						
Length in 1/10 meter [0.2 ... 4 m] longer fiber length on request														
Length in 1/10 meter [0.2 ... 4 m] longer fiber length on request														
Fiber protective tube, standard: 2.7mm OD, Kevlar (up to 20 fibers)													P	
High Temperature Fiber													H	
Fiber protective sleeve AND High Temperature fiber													T	
Pressure compensated / oil filled (housing type Ø 17 mm only)													O	
Customer specific unique identifier														

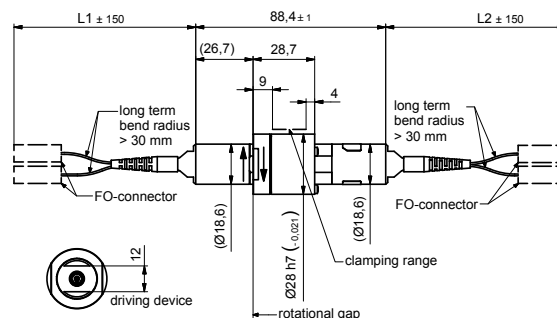
Example: RO01-FM-FCP-1515-P [SPINNER FORJ 1.17, Ø 17 mm I-Type - FC-PC connectors – 1.5 m fiber lengths for L1 and L2 – fiber protective sleeve]



SPINNER FORJ 1.17 / 1.17pc designed for the communication link to ROVs down to 4.500m operational depth.

SPINNER FORJ Multi-Channel

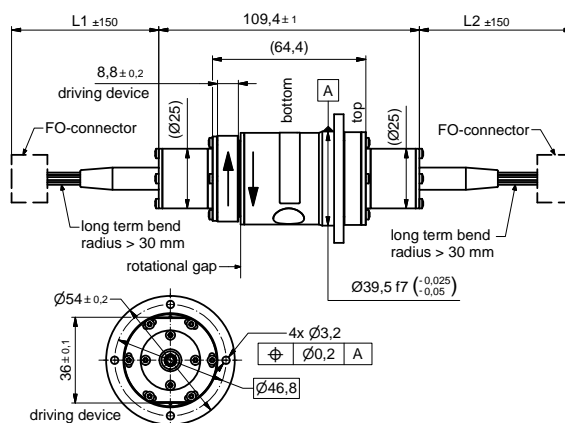
SPINNER FORJ 2.28



With the dual channel SPINNER FORJ 2.28 we meet the demand for a pure two channel single-mode rotary joint. The patented mechanics give a compactness with a total length of just less than 90 mm and an

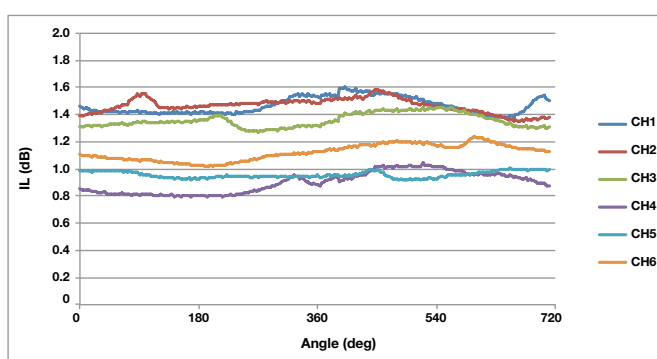
outer diameter of only 28 mm. Moreover, we provide with this flexible design options for a pure multi-mode or combined assembly of single-mode and multi-mode fibers.

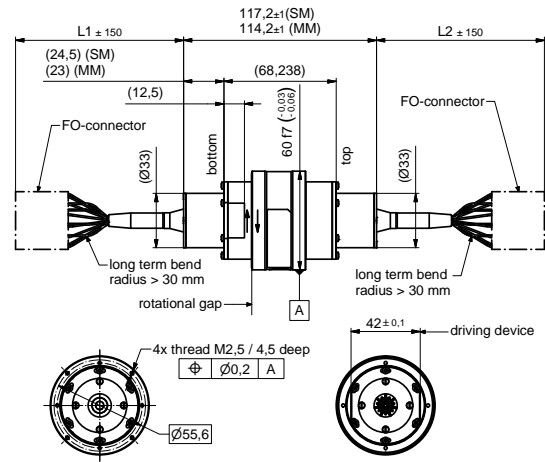
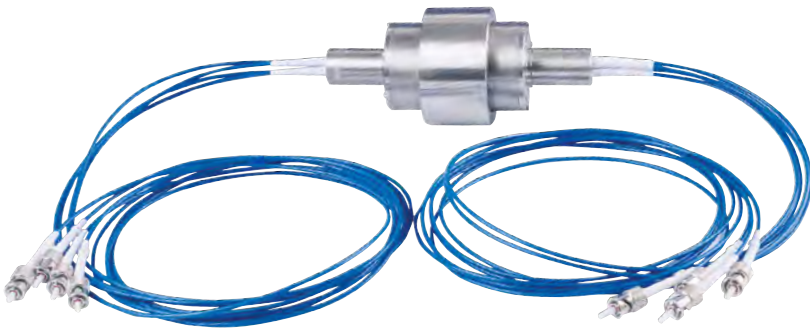
SPINNER FORJ x.40



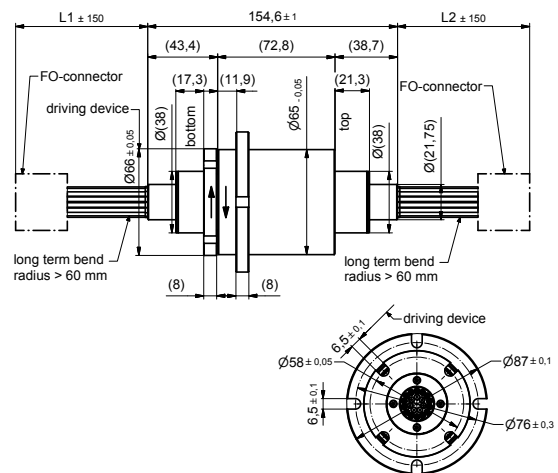
The SPINNER FORJ x.40 provides a market leading compactness for multi-channel solutions up to 6 channels and comes with an outer housing diameter of only 39.5 mm. It is available in single-mode and multi-mode fiber configuration as well as the mixed fibermode assembly.

The SPINNER multi-channel rotary joints use a dove prism for de-rotating an image of the input fiber to allow coupling to the output fiber. On each single light propagation path SPINNER relies on discrete mounted collimators for channel counts up to 20, rather than applying an optical lens array. This technology allows individual adjustment and optimization of insertion loss values for each optical fiber channel. The result is a superior optical parameter tracking performance amongst optical channels over rotation.



SPINNER FORJ x.60

For multi-channel applications beyond 6 channels SPINNER FORJ x.60 covers the full range from 7 up to 52 channels. We provide this again in single-mode and multi-mode fiber configuration as well as the mixed fibermode assembly.

SPINNER FORJ x.65

Where roughest environments do matter SPINNER FORJ x.65 withstands highest vibration and shock requirements as well as humidity combined with seawater. This design is derived from the needs of offshore and military industries and is IP 68 rated. With this design we support up to 52 channels in single-mode and multi-mode fiber configuration as well as the mixed fibermode assembly for channel counts up to 20.

SPINNER FORJ Multi-Channel Specification with Discrete Lens Technology for Single-Mode (SM) and Multi-Mode (MM) fiber

SPINNER FORJ	2.28	x.40	x.60	x.65
Channel Count	2	3-6	7-20	
Insertion Loss max.	4.5 dB (SM) / 6.0 dB (MM)	3.5 dB (SM) / 3.5 dB (MM)	3.5 dB (SM) / 5.5 dB (MM)	
Insertion Loss variation over rotation max.	1.5 dB	1.5 dB	1.5 dB	
Return Loss	50 dB (SM) *)	50 dB (SM) *)	50 dB (SM) *)	
Wavelength	1310 nm / 1550 nm (SM) or 850 nm / 1300 nm (MM)			
Fiber type	Single-Mode E9/125 or Multi-Mode 50/125 or Multi-Mode 62.5/125			
Rotation speed	150 rpm	1000 rpm	150 rpm	30 rpm
Weight (excl. connectors)	250 g	700 g	1500 g	
Torque	0.08 Nm	0.15 Nm	0.15 Nm	
Degree of protection	IP54	IP54	IP54	IP65, Seawater Resistant
Recommended temperature range	-40 °C to +85 °C (Buffered Fiber) / -40 °C to +71 °C (Protective Tube)			

*) not applicable for MM

Feel Free to Configure your SPINNER FORJ Multi-Channel with the Ordering Number Nomenclature :

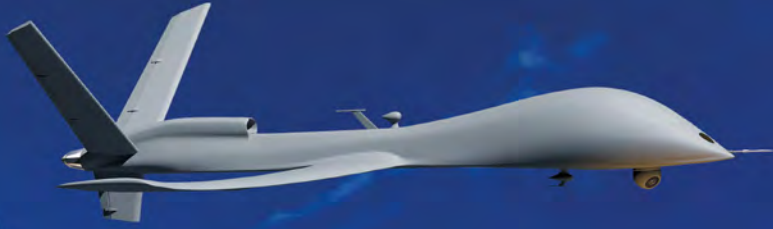
Rotary Joint	Fiber Optic	Channel Count		Housing Type	Fiber Type		Connectors	Polish		Length L1	Length L2		Extra Feature	Customer Specific UID
R	O	NN	-	X	Z	-	XX	Z	-	XX	ZZ	-	X	XX
<div>Ø 65 or 60 mm [07 ... 52]</div> <div>Ø 40 mm [03 ...06]</div> <div>Ø 28 mm [02]</div>							Any of below listed combinations possible. Please note different polish types for Single-Mode and Multi-Mode fibers. In case of Stratos S900, blank for polish.						Blank if not applicable	Filled in by SPINNER
<div>Ø 65 mm (I-Type) IP65</div> <div>Ø 60 mm (I-Type) IP54</div> <div>Ø 40 mm (I-Type) IP54</div> <div>Ø 28 mm (I-Type) IP54</div>				A										
Single-Mode E9 / 125					S									
Multi-Mode G50 / 125					M									
Multi-Mode G62.5 / 125					N									
Connector Type				Polish Multi-Mode	Polish Single-Mode									
FC				PC	UPC, APC, PC		FC							
SC				PC	APC, PC		SC							
ST				PC	PC		ST							
LC				PC	UPC, APC		LC							
LSA				PC	UPC, APC		LS							
LuxCis				PC	APC, UPC		LX							
Molex/LC				PC	PC		ML							
Stratos S900				N/A	N/A		S9							
PC								P						
APC								A						
UPC								U						
Length in 1/10 meter [0.2 ... 4 m] longer fiber length on request														
Length in 1/10 meter [0.2 ... 4 m] longer fiber length on request														
Fiber protective tube, standard: 2.7mm OD, Kevlar (up to 20 fibers)														
High Temperature Fiber														
Fiber protective sleeve AND High Temperature fiber														
Pressure compensated / oil filled (housing type Ø 17 mm only)														
Customer specific unique identifier														

Example: RO12-BS-FCA-2010-P [SPINNER FORJ 12.60, I-Type Ø 60 mm - FC-APC connectors – 2.0 m fiber length for L1, 1.0 m fiber length for L2 – fiber protective sleeve]



SPINNER FORJ x.65, IP65 and seawater resistant, designed for Tether Management Systems in offshore application.

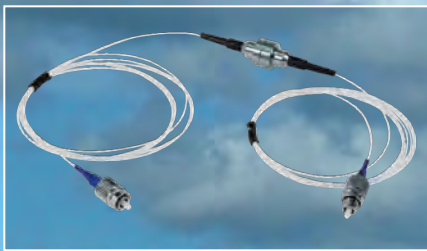




Application – UAV and Military Radar System

The SPINNER FORJ 1.14 is designed for low profile, minimum weight and rough vibration and shock environments. These FORJ is typically integrated in airborne targeting systems of UAVs, aircrafts or helicopters.

SPINNER FORJ enables in groundbased and mobile military radar systems the handling of the massive data transfer between the rotating antenna and the processing unit down in the shelter. For this application SPINNER combines multi-channel FORJ with RF rotary joints, slip rings and media joints to deliver power and cooling liquid to the antenna.



SPINNER FORJ 1.14



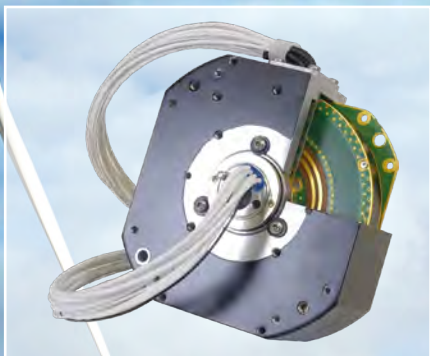
SPINNER 12 Channel FORJ
with X-Band Waveguide



Application – Wind Power and Weather Radar

In wind power stations, SPINNER FORJ 1.22 with IP65 rating increases the reliability in 24/7 operations. Where in current designs slip rings for data transmission can increase down-times and maintenance cost, the SPINNER FORJ 1.22 enables highest reliability for data transmission up to data rates of several Gbit/s. As an additional feature we provide SPINNER FORJ 1.22 in combination with digital contactless transmission systems.

For weather radar systems, SPINNER combines FORJs typically with single and dual channel RF rotary joints for frequency ranges in S-, C- and X-band. Where in current weather radar systems a slip ring transfers data to the antenna side, the SPINNER FORJ brings data rates of several Gbit/s with highest reliability to weather radar systems around the globe.



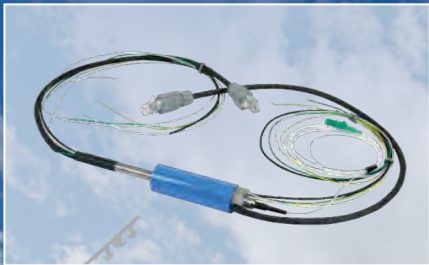
Ethernet with SPINNER FORJ 1.22



SPINNER FORJ for Weather Radar

Application – 4K / 8K Video Transmission over 360°

The miniature slip ring FORJ combinations of SPINNER with diameters down to 22mm, enable interference-free data communication at video applications in 4K and 8K quality – even in fast-moving images. The small slip ring diameter paired with SPINNER FORJ 1.14 is the perfect match for low profile applications as it saves the critical fiber bending radius in addition to the unit length. That's why manufacturers of cutting edge cameras relay on SPINNER for cable-suspended camera systems.



SPINNER FORJ 1.14



Application – Revolving Stage



Single- and multi-mode fiber optic rotary joints from 2 to 20 channels are used wherever digital signals with multi-plexing method is not tolerable. This might be the case for high performance transmission of several phased signals in radar applications, where errors due to A/D conversion are unacceptable. Another application is the usage due to a good value-cost ratio: In SPINNER FORJ 2.28 channels are transmitted separately, i.e. there is no need of complex active multi-plexing technology for each channel. As example, this is interesting for revolving stages in theaters on ocean cruises in combination with power slip rings.



SPINNER FORJ 2.28



Application – Industrial Automation

For 24/7 long lifetime applications that require DC power and a high data throughput, SPINNER provides a fully non-contacting rotary joint system. With a compact form factor integrating the fibre optic channels into the DC Power module with rotation velocities up to 3000 rpms. This hybrid rotary joint is typically implemented into high end imaging systems and industrial machining applications.

The fibre optic transmission channel provide the highest flexibility with communications protocols and data channels enabled by wavelength division multi-plexing (WDM) technologies. As an additional advantage of the new system, SPINNER has implemented FC/PC – adapters instead of flying cables. This allows ease of integration in rough environments without handling of sensitive optical fibers and possibility to choose connecting fiber types.

The nominal output voltage of this system is 24 V DC, however the applied technology allows flexible adoption to higher or lower voltage and current.



SPINNER FORJ with Contactless Power

Fiber Optic Channel Characteristics

Interface type / material	FC/PC - adapter / copper alloy
Fiber type	E9/125 single-mode
Wavelength [nm]	1310 / 1550
Return loss, min. / typ.	30 dB / 37 dB
Insertion loss, max.	8 dB
Insertion loss, WOW max.	3 dB
Optical power, max.	200 mW / 23 dBm

DC Power Transmission Channel Characteristics

Input voltage	21.6 to 27.6 V DC
Output voltage	24 V DC $\pm 3\%$
Output current, continuous	1.5 A

Application – Life Science

Life Science is an emerging field of science and industry, which deals with processes and structures of living organisms. It shows a strong relationship also to biotechnology and medical applications. In particular, it is a very interdisciplinary field of science. In several applications fiber optic rotary joints are necessary, e.g. optical coherence tomography in endoscopes. Also the field of optogenetics, where light is applied at different wavelengths to light-sensitive proteins in order to modify cell or tissue performance, uses fiber optic rotary joints.

With research conducted on freely moving mammals, the corresponding light output is applied in-situ via a glass fiber. To ensure that the freedom of movement is not limited, rotary joints are the optimal solution. Another application is support of equipment on rotatable heavy duty arms, where a rotary joint is involved.

As an established supplier to the world of medical technology, for this application, SPINNER provides a robust, cost-effective and easy-to-use rotary joint with F-SMA or FC/PC connections for large core fibers with a core diameter starting from 200 μm – BN 549706 for wavelength of 400 nm up to 2000 nm. This rotary joint stands out due to its small operating torque and small insertion loss variation during rotation. Due to the design as a coupling joint a maximum configurability is possible, which means the user is for himself able to decide on which optical fiber type is used. The rapid changing of the fiber cable also enables the rapid changing of the test subject, as well as being able to continue to use the rotary joint with a different fiber standard at a later point in time.

One of our new products is a single-mode FORJ for wavelength of 450 nm. This can be used for different applications, e.g. for free moving mammals connected to an optical single-mode fiber.

For the endoscopes we developed a high speed rotary joint, which allows to rotate up to 10000 rpm and beyond.

Part Number	BN 549706
Interface type / material	F-SMA-f / cooper alloy
Wavelength [nm]	400 - 2000 (depends on used fiber)
Insertion loss, max.	2.0 dB (with 200 μm core fiber patch cables)
Insertion loss, WOW max.	0.5 dB (with 200 μm core fiber patch cables)
Ambient temperature range operation	-32 °C ... +71 °C
Ambient temperature range storage	-40 °C ... +85 °C