

# SPINNER

## Contactless Data Transmission in Wind Turbines

PROFINET  
PROFIBUS  
EtherCAT  
Sercos III  
Bluecom  
CAN

12 m/s 18°C

22°



Real Time Data Transmission for Pitch Controls  
Reliable & Maintenance-Free

HIGH FREQUENCY PERFORMANCE WORLDWIDE  
[www.spinner-group.com](http://www.spinner-group.com)



## The SPINNER Group

For more than 75 years, the SPINNER Group has been setting new standards worldwide in high-frequency technology. Based in Munich with production facilities in Germany, Hungary and China, SPINNER currently has over 900 employees. Our international network of subsidiaries and distributors supports customers in over 40 countries.

### SPINNER Rotating Solutions

SPINNER has become one of the leading manufacturers in **rotary joints** thanks to its innovative approach, technical expertise, and high standards of quality. Our products are used in **maritime applications (both above and below water), on land, in the air, and in space.**

Across all applications, the trend toward digitization and increasing data transmission rates is continuing. Our contactless modules for rotating systems deliver benefits whenever slip rings are inadequate due to large outer diameters and/or high data transmission rates.



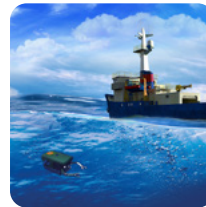
WIND ENERGY



INDUSTRY



SATCOM



SUBSEA/OFFSHORE



SPACE



RADAR

### Topnotch Portfolio for Rotating Solutions

The leading innovator in **rotating systems**, SPINNER provides the largest range of transmission technologies. All of the products listed below are designed and manufactured in-house. Slip rings and encoders from various manufacturers can also be integrated into hybrid systems on request.

- RF Single Channel Coax & Waveguide Rotary Joints
- RF Multi Channel Coax & Waveguide Rotary Joints
- Rotary Joints for Space
- Complex Hybrid Rotary Joints
- Contactless Power Modules
- Fiber Optic Rotary Joints
- Ethernet & Data Couplers

### ISO Class 7 Cleanroom Environment for Fiber Optics

All fiber-optic components are assembled in an ISO14644 Class 7 cleanroom environment and 100% tested. Every component is assigned a unique serial number.



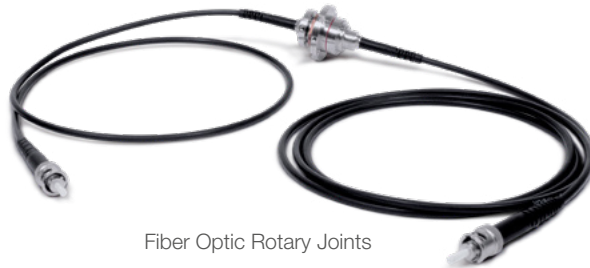


# Contactless Data Transmission in Real Time for Wind Turbines

Use of Ordinary Slip Rings for Data Transfer is the Past.  
**Electronic Contactless Couplers and Fiber Optic Rotary Joints are the Future!**



Electronic Contactless Coupler



Fiber Optic Rotary Joints

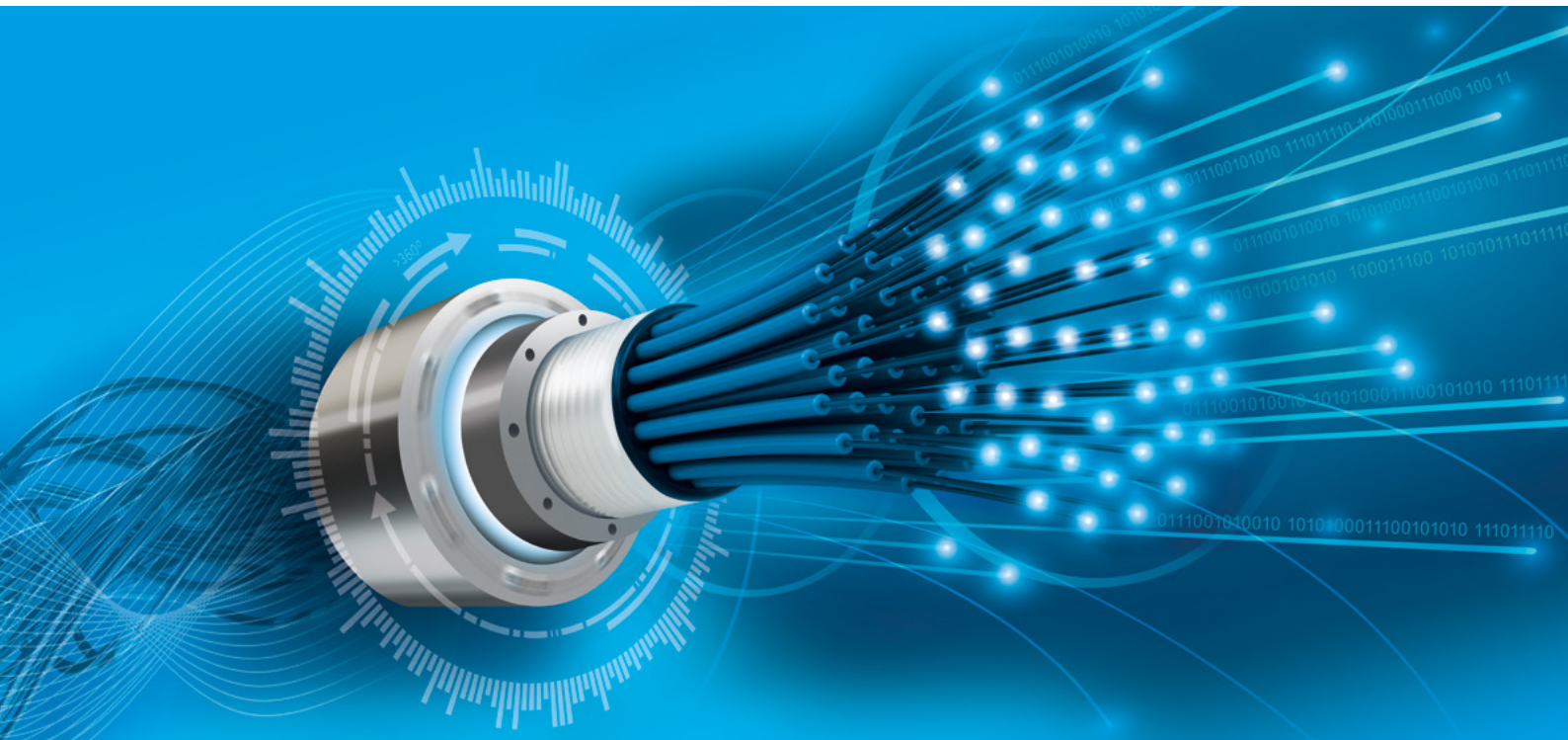
**Today's wind turbines have to meet increasing demands with regard to energy yield, efficiency, and reliability. To meet them, the systems linking the rotor blades and the control electronics in the nacelle must transmit signals at ever-greater speeds. To optimize data transfer, SPINNER offers innovative solutions that have been specially developed to meet the requirements of the wind power market.**

Day after day, wind turbines simply stop turning and power generation drops to zero, resulting in lost income. The possible causes vary greatly, but one of the principal ones is faulty transmission of data for pitch control, which sets the blades to the best angles for the wind to turn the rotor.

Data is normally transmitted via slip rings, but these are subject to wear. The result is eventual loss of dependability, and down times for maintenance are inevitable.

**SPINNER's contactless couplers and fiber optic rotary joints, which now replace a part of the slip ring, take this into account and enable fault-free data transmission in real time.**

# Contactless Data Transmission per Fiber Optic Rotary Joints



## Data Transmission for Harsh and Moist Environments

**SPINNER is one of the world's leading manufacturers of high-performance rotary joints. For cases in which data transmission via optical fibers is preferred, SPINNER supplies a large selection of single- and dual-channel rotary joints for a vast spectrum of applications.**

Fiber optic rotary joints (FORJs) in particular require demanding optical and mechanical manufacture. SPINNER meets these requirements. We provide all of the mechanical and optical parts in top quality from a single source.

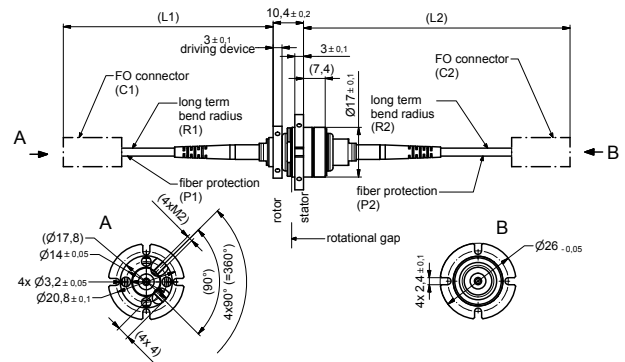
All rotary joints are available in multimode or single-mode versions and with any common connector type. For pitch control in wind turbines, great attention has been paid to engineering these products to perform reliably in harsh and wet environments.

Their **service life is more than 600 million revolutions** at 30 rpm within a temperature range from -40 to +85 degrees Celsius. The optical fibers are protected, and both their length and the connectors can be flexibly varied to meet customer wishes.

## Single-Channel SM/MM Fiber Optic Rotary Joint - IP68

For very harsh environmental conditions such as 100% humidity, SPINNER FORJ 1.17 features a protection rating of IP68. Aramid enforced protective fiber tubing prevents damage to fibers during installation and operation.

In wind power stations, this fiber optic rotary joint ensures highly reliable 24/7 data transmission.



### SPINNER FORJ 1.17 - IP68\*

- Multi-mode and single-mode versions available
- IP68
- Low insertion loss and WOW
- High return loss:
  - Multi-mode typ. more than 40 dB,
  - Single-mode typ. more than 50 dB
- $600 \times 10^6$  revolutions at 30 rpm
- Customized connectors and fiber lengths with protection solutions
- Customized flanges
- Kevlar- or metal-enforced protective tube
- Temperature range  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Housing: saltwater-resistant steel, Arcap AP 1 D
- Humidity 100%

\*Cable lengths, connectors, IP classes and number of channels on request

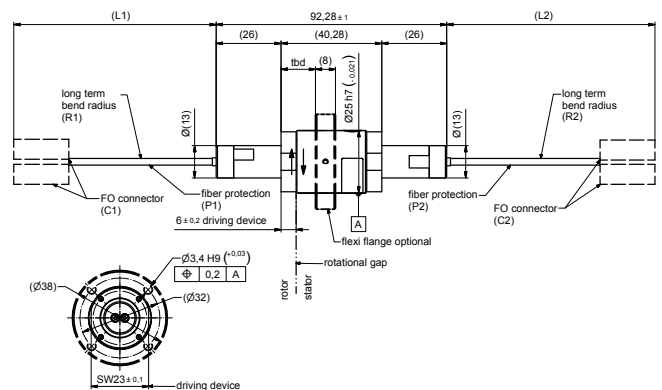
## Multi-Channel Fiber Optic Rotary Joints

SPINNER multi-channel rotary joints use a dove prism to derotate images arriving via the input fiber for coupling with the output fiber. For up to 109 channels, SPINNER relies on discretely mounted collimators for the individual light propagation paths. This technology makes it possible to flexibly adjust and optimize the insertion loss values of each optical fiber channel.

### SPINNER FORJ 2.25 - IP65

The SPINNER FORJ 2.25 is a robust 2-channel FORJ perfectly matching the needs in the rough environmental conditions of onshore and offshore wind turbines. The cost-effective FORJ therefore features a protection rating of IP65 during its entire service life, and the fibers are protected by an aramid-reinforced cable or metal tube. The mechanical system is also compact and lightweight, thus ensuring low insertion loss.

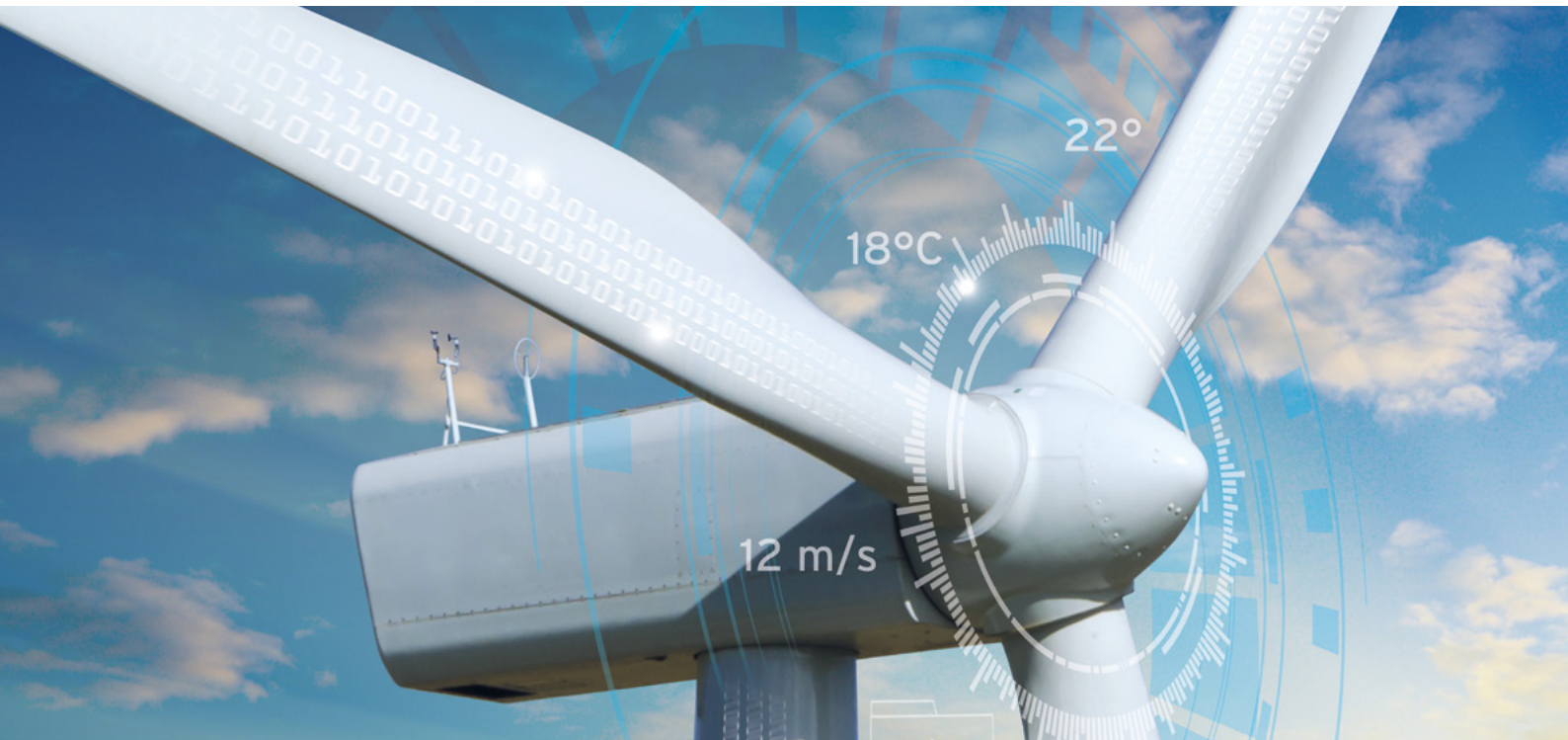
The two fibers can either transmit the same data for redundancy or else different signals as wished. When installed in pitch slip rings, the FORJ 2.25 enables the simultaneous use of two independent bus systems. Another option is to use a multiplexing unit such as a coarse wavelength division multiplexing (CWDM) system.



- Multi-mode or single-mode version
- IP65
- Low insertion loss and WOW
- High return loss typically greater than 40 dB
- $200 \times 10^6$  revolutions at 30 rpm
- Typical connectors and fiber length with protection solutions



## Contactless Data Transmission via Electronic Couplers

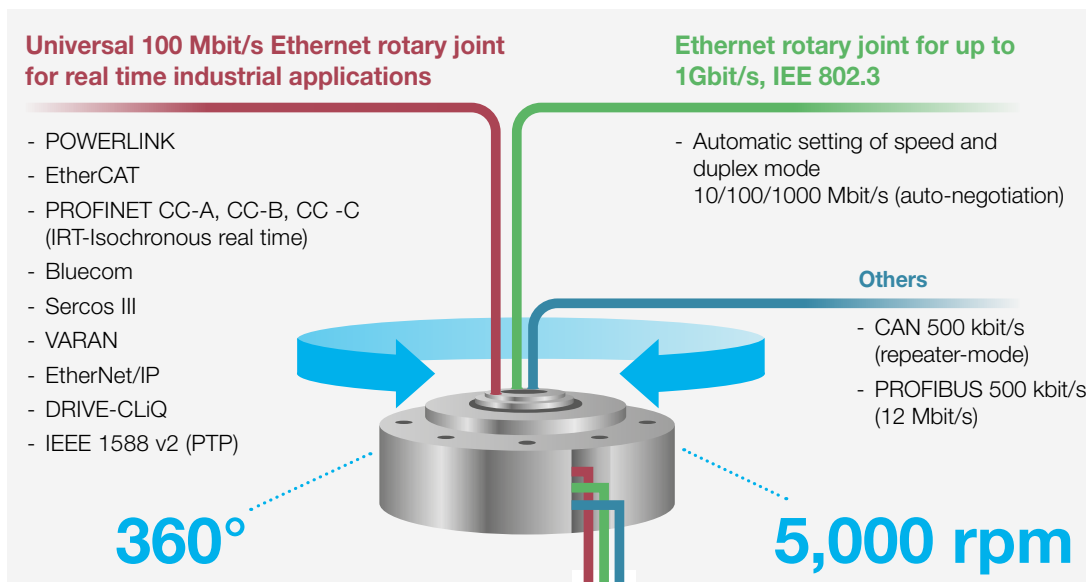


### Reliable and Maintenance-Free “All in One” Electronic Data Couplers

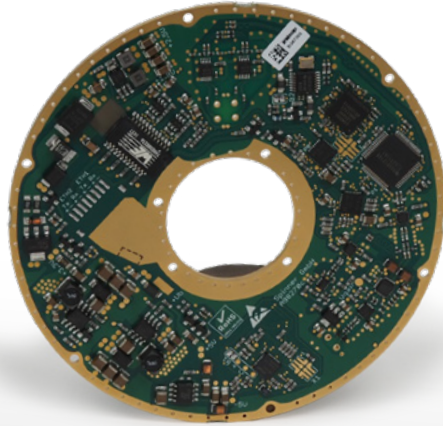
Because pitch slip ring systems are unable to consistently maintain high data transfer rates without any interruptions, SPINNER has developed capacitive, contactless rotary joints that allow maintenance-free data transfer that reliably transmit up to 1 Gbit/s of Ethernet data.

When integrated in pitch slip ring systems, these systems transmit (real-time) data protocols based on IEEE 802.3 such as POWERLINK, EtherCAT, PROFINET, Bluecom or Sercos III. Special modules for PROFIBUS and CAN are also available. All modules work without packet losses and the bit error rate (BER) is smaller than  $1 \times 10^{-12}$ , even at 99% bus capacity.

### Overview of Data Transmission Bus Protocols



## SPINNER Contactless Data Modules



All-in-one solution for real-time data protocols based on IEEE 802.3

### Benefits

- ✓ Consistently reliable, high-speed data transmission at up to 1 Gbit/s
- ✓ Real time data transmission at 100 Mbit/s (two channels available on one PCB set)
- ✓ Longer service life (contactless system: approx.  $300 \times 10^6$  rotations, compared to only about  $70 \times 10^6$  with slip rings)
- ✓ Low BER at high speeds  $< 1 \times 10^{-12}$ , no data packet losses even at 99% traffic
- ✓ Consistent performance independently of the temperature and rotational speed
- ✓ Better performance with large inner bores
- ✓ No micro-interruptions
- ✓ No WiFi, 100% tap-proof
- ✓ Abrasion-free, no maintenance required
- ✓ Reduced mechanical torque of the hybrid system
- ✓ Acts like a cable connection, no need for software adjustments, additional gateways or data converters
- ✓ => “All-in-one solution” with only two PCBs
- ✓ Minimal scheduled maintenance requirements



# Single-/Dual-Channel Data Transmission for Ethernet-Based Real Time Protocols



SPINNER BN 637421: Single-/dual-channel data transmission

Available Configurations for BN 637421C000X:

Type X	
1	1000BASE-T Ethernet
3	CAN-channel (500 kbit/s repeater)
4 + 5	1 channel 100BASE-TX, for real time Ethernet applications
7 + 8	2 channels 100BASE-TX, multiplexed, for real time Ethernet applications
9	PROFIBUS DP according to IEC 61158, 500 kbit/s

Example: Type 7 - BN 637421C0007 (2 Channel Multiplexed PROFINET Class C or EtherCAT)

100BASE-TX Ethernet Channel	Two signal channels over one contactless transmission channel, signals are multiplexed, no redundancy	
	Type 7	Type 8
Supported Ethernet standards	100BASE-TX (IEEE 802.3 clause 25), autonegotiation (full duplex only)	100BASE-TX (IEEE 802.3 clause 25), autonegotiation (half duplex only)
Supported protocols	PROFINET CC-A, CC-B, CC-C (IRT), POWERLINK and others	
OSI layer operation	Layer 1 (physical)	
Multiplexer	Time domain multiplexing	
Ethernet frame loss ratio according to RFC2544	$\leq 1 \times 10^{-9}$ Measured for 8000s with 64 byte frames at 99% channel utilization, corresponds to BER $\leq 1 \times 10^{-12}$	
Data interface connection	Cat. 6A S/FTP 4x2xAWG26/7 (PiMF) at stator and rotor side	
Power supply	24 V / 0.33 A	

## Single-Channel Data Transmission - PROFIBUS



SPINNER BN 637421C0009: Single-channel data transmission - PROFIBUS 500 Kbit/s

### Interface, PROFIBUS DP - IEC 61158, RS-485

Supported PROFIBUS standard	PROFIBUS DP according to IEC 61158
Signal-channel characteristics	PROFIBUS DP RS-485, half duplex
Data rate	500 kbit/s (other baud rates available)
Data format	UART (11 bits, NRZ)
Data interface connection	PROFIBUS cable with 7.8 mm outer diameter on rotor and stator sides, shielded twisted pair AWG24; impedance of $150\Omega \pm 10\%$ ; flying leads; see drawing for lengths
Termination	Internal, permanently terminated
Bit delay	< 2 bits
Bit distortion, input	500 kBaud $\pm$ 3.5%
Bit distortion, output	< 1%, retiming of bits
Power supply	24 V / 0.33 A







## HIGH FREQUENCY PERFORMANCE WORLDWIDE

SPINNER designs and builds cutting-edge radio frequency systems, setting performance and longevity standards for others to follow. The company's track record of innovation dates back to 1946, and many of today's mainstream products are rooted in SPINNER inventions.

Industry leaders continue to count on SPINNER's engineering excellence to drive down their costs of service and ownership with premium-quality, off-the-shelf products and custom solutions. Headquartered in Munich, Germany, the global frontrunner in RF components remains the first choice in simple-yet-smart RF solutions.

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