

Pepperl+Fuchs invented and introduced the first inductive proximity sensor in 1958. Over the years we've extended our product portfolio to include ultrasonic, photoelectric, and capacitive sensors, rotary encoders, vision sensors, AS-Interface, RFID and barcode systems, and a complete line of cordsets and accessories. We continue to increase our product range with ongoing innovations.



Whether you require a standard sensor or something unique to your application, Pepperl+Fuchs can deliver the world's most comprehensive selection of sensing technologies for wind energy applications.



Able to withstand the wind turbine's demanding environments, Pepperl+Fuchs' unique line of extended sensing range, extended temperature range, and stainless steel, metal-faced inductive proximity sensors provide unsurpassed longevity and reliable position sensing performance.



Incremental and absolute rotary encoders, in both hollow-shaft and solid-shaft versions, offer the industry's broadest range of interfaces, including CANopen, SSI, AS-interface, DeviceNet, Parallel, and PROFIBUS, so interfacing to wind turbine control systems is never a problem.

## FACTORY AUTOMATION — SENSING YOUR NEEDS



Pepperl+Fuchs sets the standard in quality and innovative technology for the world of automation. Our expertise, dedication, and heritage of innovation have driven us to develop the largest and most versatile line of industrial sensor technologies and interface components in the world. With our global presence, reliable service, and flexible production facilities, Pepperl+Fuchs delivers complete solutions for your automation requirements—wherever you need us.

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 **PEPPERL+FUCHS**  
SENSING YOUR NEEDS

FACTORY AUTOMATION



## SENSOR TECHNOLOGY FOR WIND ENERGY APPLICATIONS



 **PEPPERL+FUCHS**  
SENSING YOUR NEEDS



## FIELD-PROVEN SENSORS FOR WIND ENERGY APPLICATIONS

Extreme performance, durability, and reliability are prerequisites for all key components used in wind energy applications. It's the only way to achieve the operating efficiencies and up-time required in today's competitive energy market. Field-proven sensors and rotary encoders from Pepperl+Fuchs meet these demanding requirements, providing dependable performance in even the most challenging environments and applications.

With our broad product offering, available from a single source, our experts can help you select the appropriate sensing technologies for your specific application. With locations on six continents, our global presence enables Pepperl+Fuchs to offer the best of both worlds: extremely high engineering standards combined with efficient, low-cost manufacturing capabilities. We have exactly what you need to make your wind energy systems efficient, rugged, and reliable.

### COMPETENCE AT A GLANCE

■ Pepperl+Fuchs has over 10 years of experience in delivering reliable sensors to the wind power industry worldwide; we're a valued supplier to four of the top five wind turbine manufacturers in the world.

■ In partnership with valued customers, Pepperl+Fuchs has developed unique solutions to address the special requirements and specifications of the wind energy market.

■ Together with leading wind industry certification agencies TÜV and Germanischer-Lloyd (GL), Pepperl+Fuchs is an active participant in the development of performance and test standards for both onshore and offshore wind applications.

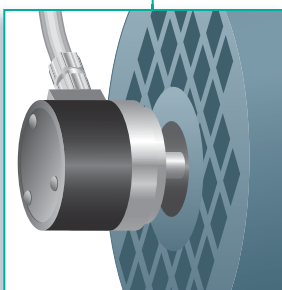
■ Our stability as a world leader in presence and position sensing ensures a long-term partnership with our valued customers.

### PITCH CONTROL SOLUTIONS



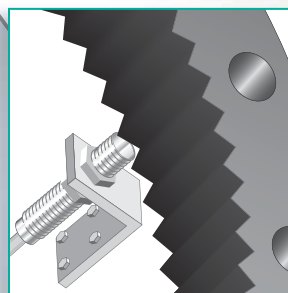
#### Magnetic Encoder

- AMR/GMR technology
- Up to 3600 pulses per revolution
- Ultra rugged – up to 200 g shock resistance, 40 g vibration resistance
- -40 °C to 100 °C
- Unaffected by harsh environments



#### Inductive Proximity Sensors

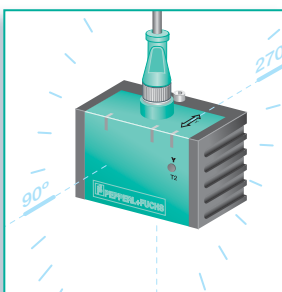
- Senses motion of pitch slew rings and drive gears
- Mobile equipment-rated for exceptional reliability
- Wide range of sizes and styles to fit every application



#### Absolute Rotary Encoders

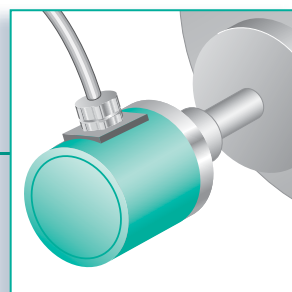
- Mount directly to pitch drive or on idler gear
- Monitors absolute blade pitch position, even through power loss
- IP65 protection class

### ROTOR/HUB ANGULAR POSITION DETECTION



#### Inclination Sensors

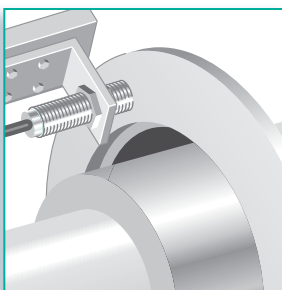
- 0 to 360° rotational position
- Reliable – no moving parts!
- IP68/IP69K protection class
- 0.1° angular resolution



#### Absolute Rotary Encoders

- Up to 30 bit resolution
- Solid, hollow, and recessed hollow shaft styles
- Up to IP65 protection class

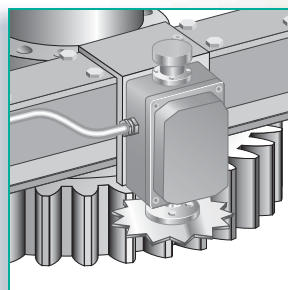
### MAIN SHAFT DEFLECTION MONITORING



#### Analog Proximity Sensors

- Detects rotor load-induced deflection of main shaft
- 4-20 mA or 0-10 VDC output; +/-10% linearity
- IP67 protection class

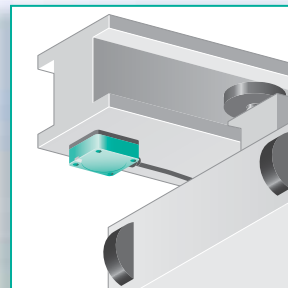
### CABLE TWIST SENSOR



#### Rotary Encoders

- Track nacelle rotation to prevent cable twisting
- Absolute encoders maintain position data through power loss
- Incremental encoders available with SIL3, PLe rating

### SERVICE HOIST CONTROL



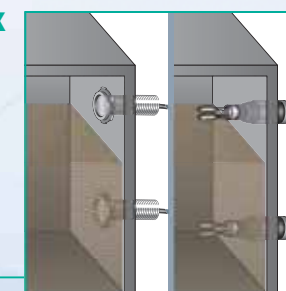
#### Inductive Proximity Sensors

- End of travel detection
- Wide variety of housing and mounting styles
- Cost effective and reliable

### LEVEL MONITORING FOR GEARBOX LUBRICATION AND COOLANTS

#### Capacitive Sensors

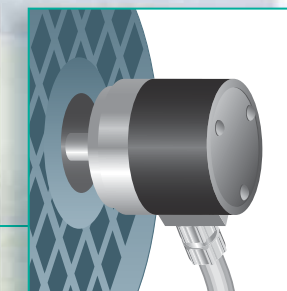
- Noncontact level sensing
- Cylindrical and surface mount styles
- 1 mm to 50 mm range
- Stainless steel and crastin housings



#### Vibracon Sensors

- 100 °C and 150 °C liquid temperature versions available
- Small, slender design for easy mounting in limited-access locations

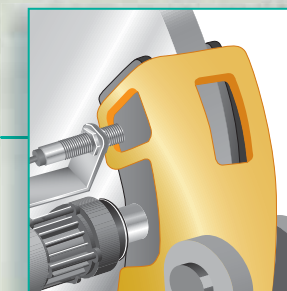
### GENERATOR RPM MONITORING



#### Incremental Rotary Encoder

- Reliable, accurate feedback of generator speed
- Up to 10,000 pulses per revolution
- Styles to fit a variety of mounting configurations, including slip rings
- Durable optical technology for use in the most demanding environments

### BRAKE PAD POSITION/WEAR MONITORING



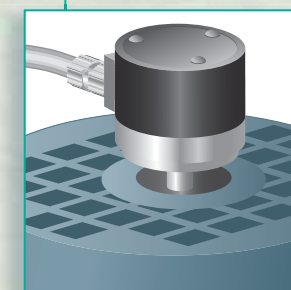
#### Inductive Proximity Sensors

- Senses position of brake pads or actuator piston
- Wide variety of housings and mounting styles
- Mobile equipment-rated for exceptional reliability

#### Analog Proximity Sensors

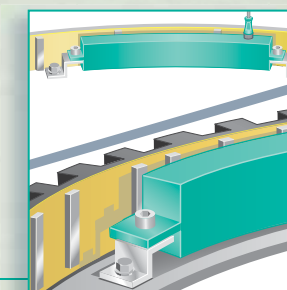
- Detects amount of wear on friction surfaces to facilitate scheduling of preventive maintenance
- 4-20 mA or 0-10 VDC output; +/-10% linearity
- IP67 protection class

### YAW POSITION SOLUTIONS



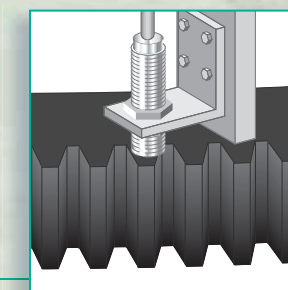
#### Absolute Rotary Encoders

- Mount directly to yaw drive
- Sense motion and direction to determine position of slew ring gear
- Absolute position maintained even through loss of power



#### Position Coding System

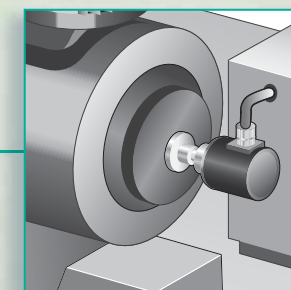
- Absolute, noncontact determination of angular position of slew ring
- Extremely reliable and resistant to soiling
- Analog output signal proportional to range of motion
- Resolution: 1/1000th of full range



#### Inductive Proximity Sensors

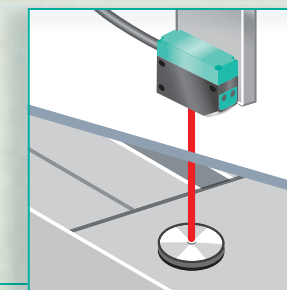
- Directly sense gear teeth on slew ring or targets on yaw drive motors
- Mobile equipment-rated for exceptional reliability
- Cost effective and reliable

### LIFT CAB POSITION DETECTION



#### Rotary Encoders

- Absolute or incremental position
- Easy installation on lift drive or idler pulley



#### Laser Distance Measurement Systems

- Direct measurement of absolute cab position
- No rope/cable slip or stretch error