Wind power

Blade Intelligence –
the modular solution for efficient operation
Efficient rotor blade monitoring

Rotor blades are subjected to extreme environmental conditions and strain. In order to protect the wind turbine generator against damage, the system efficiency is increased through proper status monitoring on the rotor blade, and key safety functions are performed.

Your advantages

- Maximum availability of wind turbine generators with robust components, even under extreme conditions
- Easy integration into existing systems, thanks to open interfaces
- Maintenance work can be scheduled and the configuration adjusted via remote access
Our solution for rotor blade monitoring

With the Blade Intelligence rotor blade monitoring solution, Phoenix Contact provides you with the ability to monitor your wind turbine generator in extreme situations and to optimize the system operation. Our solution is a combination of ice detection, load monitoring, and lightning current measurement for the maximum availability of your wind turbine generator. The modular system can be adapted to your requirements.

We will introduce you to the individual systems over the next few pages. Learn more about our ice detection system starting on page 4. Get more information about our rotor monitoring system for load monitoring starting on page 6, and read more about our lightning monitoring system for lightning current measurement starting on page 8.

With Blade Intelligence, you can always keep an eye on the status of your rotor blades, which helps you react quickly to any events. Our solution is available in various versions. It can also be integrated reliably into existing systems, ensuring efficient retrofitting.

Modular system configuration

The modular design of this solution allows the individual solutions to be combined as needed depending on the requirements. Sensors developed specially for installation on the rotor blade provide all of the data necessary for processing in a common evaluation unit. Extensions with additional sensor technology are possible at any time. New technologies and wireless sensors allow sustainable and efficient maintenance management.

Operation and visualization

The data from all sensors is visualized clearly on an HMI web panel. The intuitive interfaces gives you quick access to all functions and provides you with a complete overview of what's going on with each and every rotor blade.

Installation documentation

With the app, we offer you digital support when you're installing the sensors. Right from the start, when affixing and setting up the sensors on the rotor blade, photos and other information on the installation can be documented in the app. This data is transferred to the respective controller.
Solutions for ice detection

Phoenix Contact provides a reliable ice detection system for rotor blades which will increase the yields of your wind turbine generators. Our ice detection system (ID-S) solution measures the thickness of possible ice deposits and the temperature directly on the surface of the blade.
Ice detection system

Innovative measuring technology

In particular in regions with extreme temperatures and low levels of sunlight, using ice detection sensor technology is of key importance. Thanks to high temperature resistance and long darkness reserves, our Blade Intelligence system makes maximum availability possible even under extreme conditions.

Our ID-S solution allows ice to reliably be detected on the rotor blade. Thanks to measurements being taken outside on the blade, ice detection is significantly more accurate, and system downtimes can be reduced to a minimum.

Reliable ice detection is possible thanks to the differentiation between ice and soiling. The ice formation level is then also verified through a parallel temperature measurement using the same sensor. The onset of ice formation can be detected significantly earlier. This information can be used to control an existing blade heating system optimally.

Autonomous sensors

The sensors, which are simply stuck on, measure how thick the ice coating the rotor blade is and the external temperature on the rotor blade.

- Operating temperature: -40°C ... +60°C
- Wireless range of up to 250 m
- Transmission frequency: 868 MHz / 915 MHz
- Direct energy supply via solar power
- Storage capacity for supply for over 1000 h

Your advantages

- Reliable ice detection thanks measuring how thickly the ice is coated on the rotor blades
- Maximum yields with automatic restart
- Optimized control of the blade heating thanks to temperature measuring
- Fast startup, even as a retrofit solution, thanks to preconfigured components
- Autonomous operation, because it is not necessary to integrate it into the wind turbine generator controller
Solutions for load monitoring

High dynamic forces can lead to permanent structural damage to the blades. Our rotor monitoring system (RM-S) measures the behavior under load and bending moments to estimate the remaining service life.
Rotor monitoring system

Recording load spectra

Our RM-S solution detects damage early by continuously monitoring loads and vibrations. The strain on the blades is reduced to a minimum. The measured values are used to determine the minimum, average, and maximum bending moment and the rotational speed of the rotor. Collecting information on the occurring load spectra creates a record of the vibration amplitudes which cause structural damage to the rotor blades over the entire service life. The values recorded therefore allow you to estimate the wind turbine generator’s remaining service life.

Robust sensor design

The strain gauges, developed specially for use in wind turbine generators, are affixed to the inner side of the rotor blades close to the base of the blade. The special design of the sensor allows you to measure ranges which are specially adapted to the demands on the rotor blade. With sensors tailored to the respective blade type, we achieve a permanently measurable displacement of ±5‰.

The controller records the sensor signals. All of the raw data can be stored and evaluated. An alarm can be triggered if the configured limit values are exceeded. At the same time, the processed data is made available to the higher-level controller for signal scanning.

- Highly durable distension of ±5‰
- 4 ... 20 mA interface
- Integrated temperature sensor
- Temperature-compensated
- High durability
- M12 connection technology
- Pigtail connection

Your advantages

☑ Condition-based maintenance thanks to early detection of damage
☑ Reduced strain on the rotor blades with load-optimized control of the wind turbine generator
☑ Reliable operation with robust components, even under extreme conditions
☑ Open system for optimum integration into existing systems
Solutions for lightning current measurement

Time and again, lightning strikes cause rotor blade damage and electronics failures in wind turbine generators. However, in most cases, these strikes cannot be directly detected or logged. Our lightning monitoring system (LM-S) solution can precisely measure lightning strikes in a wind turbine generator’s rotor blades.
Lightning monitoring system

Lightning surge current characteristics

Our LM-S detects and analyzes all key parameters of lightning surge currents. This data allows the actual system load to be assessed. Continuous remote monitoring improves the decision-making criteria for preventive maintenance operations. The LM-S is incorporated autonomously into networks via a modem or the integrated Ethernet interface.

The system can be easily integrated into an existing control system by calling up the IP addresses. Detailed information on any lightning strikes can be called up in a web browser.

Data acquisition via real-time measurement

The LM-S measuring system sensors are mounted on the protective devices. In the event of a lightning strike, the surge current generates a magnetic field around the conductor, which is detected by the sensors. The system utilizes the Faraday effect. The magnetic field generated by the lightning has an effect on light. A previously polarized light wave becomes distorted. This distortion becomes measurable through a second polarization. This purely optical measurement also ensures that the current in the lightning conductor or the magnetic field cannot damage the sensor or the evaluation unit. The system sends the measured results to the evaluation unit via fiber optics. Based on the values obtained, the evaluation unit determines the maximum lightning current strength with the lightning current rate of rise, charge, and specific energy.

Your advantages

✔ Informative diagnostics with immediate acquisition of detailed data through real-time measurements
✔ Helpful decision-making criteria for maintenance action, thanks to remote monitoring
✔ Easy data output and configuration via integrated web server
✔ Integration into standard network systems with RJ45 interface

Faraday effect
System automation

With PLCnext Technology, Phoenix Contact provides a unique ecosystem for modern automation. Combining an open control platform, modular engineering software, and systemic cloud integration means that you can easily adapt to changing demands.
Platform for limitless automation

Matlab Simulink integration
The Blade Intelligence system is ideally suited for use in modern wind turbine generators because it uses PLCnext Technology. Integrating Matlab Simulink allows blade heating control models to be uploaded to the controller and integrated easily. With this approach, the blade heating system can react directly to changing conditions on the rotor blade.

Your advantages

☑ PLC-typical real-time performance and data consistency, even for high-level languages and model-based code
☑ Intelligent networking through cloud connection and integration of current and future communication standards
☑ Quick application development: Several developers can work independently in different programming languages

Open control platform
As a modular system, our Blade Intelligence solution works using a controller with PLCnext Technology. The infrastructure of the PLCnext Technology ecosystem allows additional functions and sensors to be added at any time. The software needed can be downloaded easily from the PLCnext Store and uploaded to the controller. This means that the system is also open for future development and can be extended at any time.
Open communication with customers and partners worldwide

Phoenix Contact is a global market leader based in Germany. We are known for producing future-oriented components, systems, and solutions in the fields of electrical engineering, electronics, and automation. With a global network reaching across more than 100 countries with over 17,400 employees, we maintain close relationships with our customers, something we believe is essential for success.

Our wide variety of innovative products makes it easy for our customers to implement the latest technology in a variety of applications and industries. We focus on developing the fields of energy, infrastructure, process, and factory automation.

You can find our complete product range at:
phoenixcontact.com