

the power to control

bachmann.

Cantilever Sensor

The most reliable blade load measurement on the market – high-tech performance through and through.

**SIMPLY
CLEVER**
CANTILEVER SENSOR



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Sometimes, it's the simple things that are most impressive.

The Bachmann Cantilever Sensor – simple, robust, reliable.

YOUR BENEFITS

- Lower sensor and system costs
- Simple installation and commissioning – low installation costs
- Very durable over the long term – lower costs from replacements and downtime
- Robust design; resistant to tough environments
- One sensor, a wide range of tasks: versatile solution for blade load detection and structural analysis
- Extremely high-quality signal
- Lower leveled cost of energy (LCoE)

Simple: Using a robust, industry-standard distance sensor, the Cantilever Sensor converts strain measurement into a stable, fault-resistant distance measurement. For example, the measurement signal must not first be transformed from an optical to an electrical signal – a process that is often prone to faults.

Robust: Thanks to its measurement principle, the Cantilever Sensor features a robust design and is easy to install. It also facilitates a very long service and operational life with little maintenance necessary.

Reliable: Despite its very robust design, the Cantilever Sensor acquires extremely accurate and reliable data.

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BEGINNING WITH THE BENEFITS.

1. Blade Load Detection

- **Lasting reduction of operating and service costs:** The use of Cantilever Sensor signals for individual pitch control enables blade load-optimized alignment between turbine design and operating strategy. This significantly reduces the Levelized Cost of Energy (LCoE) in modern turbines.
- **Significant sensor and system cost reduction:** The Cantilever Sensor's simple and robust technology replaces complex and failure-prone sensors, sensitive cables and signal converters on both blade and hub.
- **Reliable installation and easy commissioning:** The cantilever sensor is quick, simple, and easy to install. The process is completely reliable without the need for sensitive fine tuning.
- **Operate your plant without any surprises or unnecessary downtime:** Thanks to its simple and robust design, the Cantilever Sensor provides an extremely high-quality, stable signal, which reports the smallest changes clearly and reliably.

2. Structural Monitoring

- Structural changes and damage can occur on the exposed and extremely expensive wind turbine rotor blades during operation. These issues can, in turn, result in plant failure and downtime.

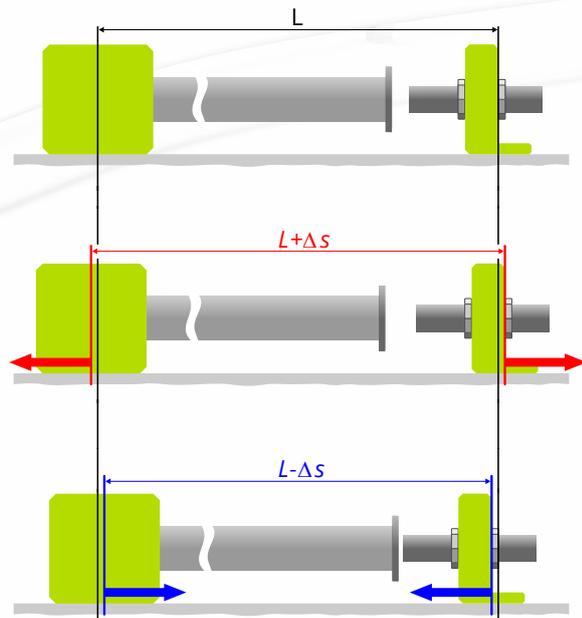
Cantilever Sensors help to solve these problems by detecting structural anomalies at an early stage, allowing them to be rectified as part of condition-based maintenance before expensive, subsequent damage occurs.

Measurement Principle

The Cantilever Sensor (CLS) measures strain and generates an output signal comparable with an electric strain gauge or fiber-optic strain sensor.

However, due to the principle of inductive displacement measurement, the CLS is not subject to any mechanical deformation.

- The measurement principle guarantees the sensor's long-term stability.
- The longer reference distance minimizes the influence of local inconsistencies typical of rotor blade composite materials.
- Installation is simple and easy to duplicate.



Detection Function in the Rotor Blade

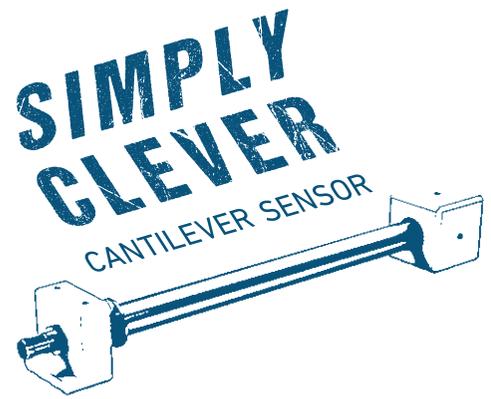
The Cantilever Sensor can be used in a wide range of applications. For example, the sensor can provide real-time information on blade loads. This makes it ideal for load-control purposes, such as IPC (individual pitch control).

The signal is recorded continuously, meaning that the remaining service life can be estimated for each specific plant. The operating and maintenance strategy of entire wind parks can thereby be optimized for the long term, ensuring the highest possible yield. Furthermore, loads

on individual blades can be compared, enabling problems such as pitch errors or blade damage to be identified at an early stage. Any necessary corrections and maintenance measures can then be initiated based on this information.

The response time and sensitivity of the Cantilever Sensor enable the easy detection of structural vibrations. Through this detection function and related analysis and structural changes (Anomaly Detection) in the rotor blades can be monitored and assessed.





Integration in the System Architecture (Installation)

Installation and commissioning are extremely simple and can be fully integrated in standardized production and commissioning processes. Trained, qualified personnel can carry out all the required steps quickly and efficiently as no specialist knowledge, special tools, or measuring equipment are required.

There are two installation methods to ensure a simple mounting process.

Standard Installation



Direct installation with mounting aid



Removal of the mounting aid

2-Stage Installation



Pre-installation of the mounting base



Removal of the mounting aid



Attachment of the CLS onto mounting base

With a broad range of applications and easy installation, Cantilever Sensors are suitable for use as part of standard equipment in new, modern plants that require innovative control and monitoring concepts. They are also ideal for retrofitting existing machinery in the field, particularly in situations where operators are looking to make cost savings within operations and maintenance.

Application Areas

The Cantilever Sensor is primarily designed to detect blade loads for control purposes, among other things. It has already demonstrated its value in numerous projects, where it has proven easy to handle and reliable during operation.

This versatile solution can also be used to monitor entire structures – from rotor blades to towers. As a result, Bachmann is able to cover the main areas of application in a modern wind turbine with just one smart sensor.



**PRODUCT
DATA SHEET**



CONTACT

*Holger Fritsch
General Manager
Bachmann Monitoring*

*T: +49 3672 3186-0
sales.BAM@bachmann.info*

bachmann.



www.bachmann.info

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