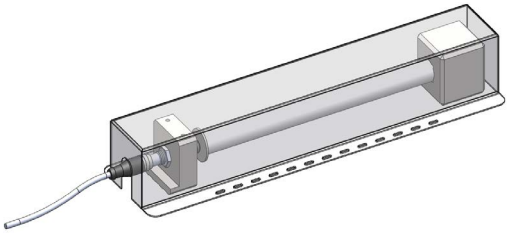
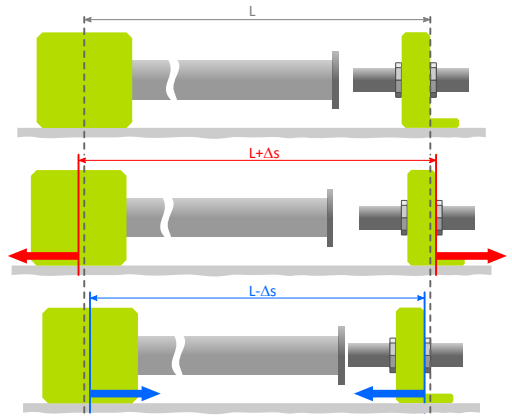
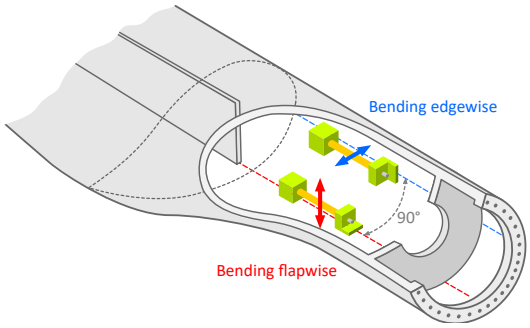
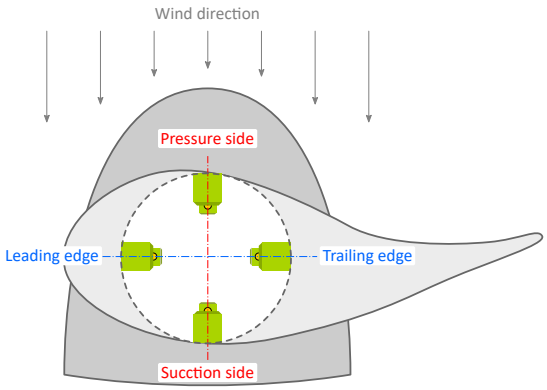


Cantilever-Sensor (CLS) with Step Protection



Measurement principle





Installation schematic in the rotor blade

Cantilever-Sensor (CLS)

The Cantilever-Sensor is a new product in the Bachmann portfolio, designed for the continuous recording of structural loads on the rotor blades of wind turbines.

Cantilever sensors measure strain, producing a value comparable to the output from electrical strain gauges or fibre-optic strain sensors. However, by using an inductive displacement measurement the CLS itself is not subject to mechanical deformation.

Compared to conventional sensor technologies, the robust design of the CLS offers the following advantages:

- The measurement principle guarantees the long-term stability of the sensor.
- The longer reference distance minimizes the influence of local inhomogeneities, typical of composite materials used for blade construction.
- The installation is simple and reproducible.

The CLS has a wide range of applications:

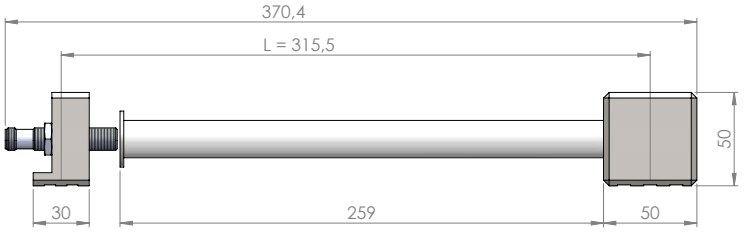
- The signal provides real time blade loading information suitable for individual pitch control.
- Continuous recording of the signal allows a facility-specific estimation of the remaining service life.
- Comparison between the different blade loadings on a single wind turbine can identify problems such as pitch errors or individual blade damage.
- The response time and sensitivity enable sampling rates sufficient to capture structural oscillations of the blade, for ice detection, and structural integrity studies.

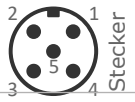
The monitoring of critical blade loads was the main focus for developing the CLS. The use of CLS signals for individual pitch control allows coordination between turbine design and operational strategy in a load-optimized way in order to considerably reduce the levelized cost of energy of modern turbines.

It also enables further specific adjustment of the pitch control strategies, either to maximise output or to extend life, providing further significant savings.

Cantilever-Sensor

Dimensions



Total length	370.4 mm	
Effective reference length L	315.5 mm	
Cantilever material	Titanium, thermal expansion coefficient 8.6e-06 / K	
Width and height	50 x 50 mm	
Mass	0.41 kg	
Target material	1.4301	
Technical Data – Sensor Element		
Measurement	Displacement / Strain	
Measurement principle	Inductive	
Measurement range	Displacement: ±1 mm	Strain: ±3170 µm/m (microstrain. µε)
Signal bandwidth	≤ 0.2 kHz	
Response time	0.5 ms	
Resolution	Displacement: 0.5 µm	Strain: 1.6 µm/m
Temperature coefficient	<0.01 % of full scale / K	
Linearity	<0.005 % of full scale	
Signal type	4 to 20 mA	
Resistance	≤ 600 Ohm at 24 VDC ≤ 25 Ohm/1 V power supply	
Output connection	Male connector axial, M12x1, A-coded, 5 poles	
Pin layout	Pin 1 Ub+ Pin 3 GND Pin 4 Signal (Pin 2/5 not connected)	
Working temperature	-25 to +75 °C	
Storage temperature	-25 to +75 °C	
Protection class	IP67	
Supply voltage	24 VDC (8 to 30 VDC)	
Power usage	0.288W @8V to 1.08W @30V	
EMV test classes	EN 55011:2009+A1:2010 / EN 55022:2010 (Class B), EN 50581:2012, EN 55016/EN 60945, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-9	
Item		
Cantilever-Sensor	On request	
Step Protection	On request	
Sensor Cable	On request	