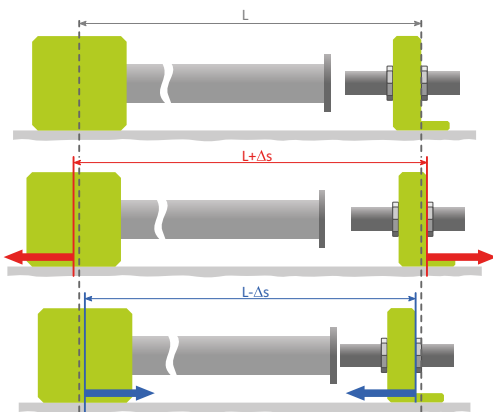
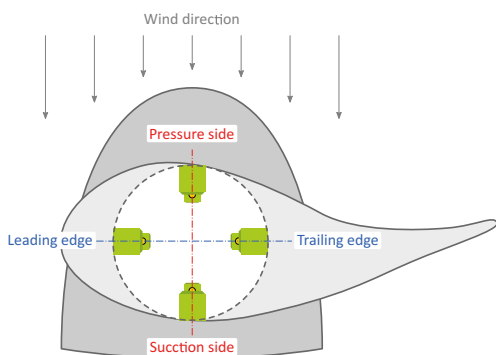
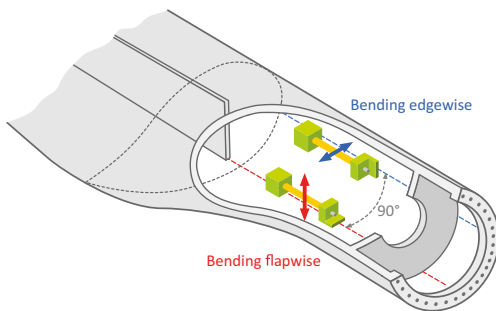


▼ Cantilever-Sensor (CLS) with Step Protection



▼ Measurement principle



▼ Installation schematic in the rotor blade

## Cantilever-Sensor (CLS)

The Cantilever-Sensor was designed for the continuous load recording on the rotor blades as well as on tower and foundation structures of wind turbines.

The sensor unit, consisting of a cantilever fixed on one side and an opposing proximity sensor, makes it possible to convert a strain measurement into a simple distance measurement. This way, 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.
- Simple installation suitable for series production by bonding the sensor unit pre-aligned to a mounting rail.

The CLS has a wide range of applications:

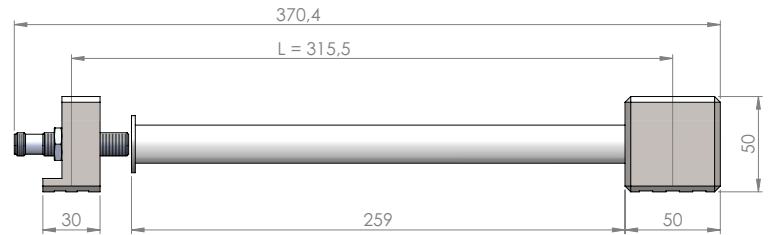
- The signal provides real time blade loading information suitable for individual pitch control.
- Comparison between the different blade loadings on a single wind turbine can identify problems such as pitch errors or individual blade damage.
- The response time and sensitivity enable sampling rates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

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.

Thus, the CLS 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

**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	<3.0 ms	
Resolution	Displacement: < 1 µm (typically 0.5 µm)	Strain: < 3.2 µm/m (typically 1.6 µm/m)
Temperature coefficient	<0.01 % of full scale / K	
Linearity	<0.005 % of full scale	
Output signal	4 to 20 mA	
Resistance	≤ 600 Ohm at 24 VDC ≤ 25 Ohm/1 V power supply	
Output connection	Male connector axial, M12 (m), A-coded, 5 poles	
Pin layout	Pin 1 Ub+ (power supply) Pin 3 GND Pin 4 Signal (Pin 2/5 not connected)	
Temperature (storage, transport, operation)	-40 to +75 °C	
Protection class	IP67	
Supply voltage	24 VDC (8 to 30 VDC) via connecting cable	
Power usage	0.304W @8V bis 1.14W @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**

Item-No.	
BAM CLS300T M12 V01	00036043-00
BAM CLS300_ Step Protection V01	00035878-00
IM12 sensor cable 4pol A Cod. socket 20m end open	00036063-00

**Installation material**

BAM CLS300 Mounting Gauge	00035910-00
BAM CLS Installation Hook	00035940-00
Flexible adhesive base 28x28mm black (100 pcs.)	00036061-00
Rubber Band 80x4mm (1000 pcs.)	00037786-00
Adhesive LORD 406E/17 Cartridge (45 ml)	00024352-00
Sikaflex-521UV (300 ml)	00010350-00