SMS Guard™

Autonomous, retrofittable sensor kit for wind turbines

Technical Data Sheet

SMS Guard™ is a simple to install instrumentation package that enables continuous integrity monitoring of offshore wind turbines. SMS Guard™ gives operators full control of the loads acting on- and the motions of the tower and sub-structure. The data can be used for continuous integrity monitoring and early detection of anomalies both in the turbine itself, in the tower and substructure and the seabed support of the substructure.

In addition to live integrity monitoring, the data can be used by operators to maximise the operating life of offshore wind turbines and to optimise the design of future wind turbines, thus reducing LCOE considerably. The SMS Guard™ is a true IoT solution where all data is made available through an open API, enabling cloud computing and collaborative data analytics.

Key Benefits

- Live integrity monitoring of bottom fixed wind turbines
- Load and fatigue monitoring of the tower and substructure
- Continuous monitoring of substructure – seabed interaction
- Automatic detection of turbine anomalies
- Data made available through open APIs enabling data analytics and collaboration

Key Features

The system is typically installed immediately above the cable hang-off deck however, the exact elevation of the system is not critical for its functionality. The installation entails a small cabinet containing a 6-axis inertial motion unit and 4 strain sensors that are placed at 90 degrees intervals around a cross section of the tower structure. The system only requires a single power supply and either WiFi or LAN connection and will then automatically start streaming of measurement data. Once connected the operator will get immediate access to a set of standard integrity monitoring dashboards showing;

- Bending moment at the cross section where the system is installed
- Horisontal accelerations at the sensor elevation
- Rotational rates at the sensor elevation

All the above parameters will be plotted and correlated with wave height and wind speed based on satellite monitoring of the region. More advanced monitoring such as monitoring of seabed stiffness and damping, response frequency monitoring and structural fatigue can be added upon request.

4Subsea helps operators reduce cost of operations and maximise life of assets using autonomous sensors in combination with data analytics and specialist engineering competence. Products in the Smart Monitoring Sensors (SMS) range are **SMS Motion™**, **SMS Strain™**, **SMS Magic Hand™**, **SMS Gateway™**, **SMS ComCentral™**, and **SMS Guard™**. Technology applications include monitoring of wellhead integrity, risers, mooring lines, subsea spools and manifolds, as well as monitoring of pipelines and subsea structures for oil & gas and offshore wind sub-structures.

Cabinet Specification
Dimensions 38x40x21 cm (exclusive mounting)
Weight 12 kg
Connectors 2 x Ethernet (RJ-45)
2 x USB (USB type A)
2 x Wi-Fi Antenna (RP-SMA)
Power input 230 V AC including 3 m cable with Schuko plug (CEE 7/7)

UPS Specification
Two battery-backup (UPS) devices can be provided inside the cabinet to allow continuous operation across short power outages (configurable between 5 and 20 minutes)
Input 230V AC
Output 12V DC
Lithium polymer battery 2 x 26Wh capacity
Operating temperature 0°C to 40°C
Storage temperature -20°C to 45°C
Relative humidity ≤ 95% (operation)

Computer Specification
CPU type AMD A10 Micro-6700T SoC
CPU cores 64-bit Quad Core
Clock speed 1.2GHz (boost up to 2.2GHz)
Memory 8GB
Storage 120 GB SSD
LAN Gigabit Ethernet
Wireless WLAN 802.11ac (2.4/5GHz)
Bluetooth 4.0
Operating temperature -20°C to 70°C
Relative Humidity 10% to 90% (operation)
MTTF > 100,000 hours

Motion Sensor Specification
Accel range +/-2g (optional +/-4, 8 or 16)
Noise level, Ax, Ay 0.00052g rms @ 5Hz bandwidth
Noise level, Az (vertical) 0.00087g rms @ 5Hz bandwidth
Gyro range +/- 250°/s
Noise level, Gx, Gy, Gz 0.012°/s rms @ 5Hz bandwidth
Logged data Ax, Ay, Az (acceleration), Gx, Gy, Gz (gyroscope), Roll, Pitch, Temperature
Logging mode Continuous (no inactive periods)
Sampling/logging frequency 10 Hz -125 Hz
Storage capacity 32 GB
Typical logging time 68 months of continuous logging of 6 DOF @ 10Hz frequency
Operating temperature 0° C to 30° C
Storage temperature -5° C to 50° C

Used as Pitch and Roll Inclinometer
Angular orientation range +/- 90°
Calibrated range +/- 5°
Frequency range 0Hz (stationary) to 0.5Hz
Pitch and Roll noise level 0.012° rms (fs=10Hz)
Resolution (1) 0.024° (fs=10Hz)
Static accuracy (2) 0.072°

Strain Sensor Specifications
Full scale range +/- 2700 µStrain
Measurement frequency 10Hz
Resolution <0.5 µStrain
Noise Level <0.4 µStrain rms
Magnetic force >120N
Material Stainless steel 316L
Dimensions 80x50x62 mm
Weight 950 g
Operating temperature 0° C to 30° C
Storage temperature -5° C to 50° C
Operating voltage 3.6 V
Current consumption <0.5 mA (logging at 10Hz)

1) Resolution is defined as 2σ where σ is the standard deviation or rms value of the sensor noise level (which depends on the bandwidth).
2) Accuracy is defined as 2σ + ε where σ is defined in 1) and ε is the total error over the entire angle- and temperature range.

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4Subsea is a leading provider of technology and services that help operators optimise energy production from subsea oil & gas fields and offshore wind farms. We combine domain expertise with data analytics and digital services to maximise lifetime of assets, reduce operational cost and optimise future projects through data-driven design.

The company was established in 2007 and clients include the major energy operators as well as the large suppliers of sub-sea equipment. 4Subsea is headquartered in Asker, Norway with additional offices in Bergen, Kristiansand, Stavanger, Rio de Janeiro, and Aberdeen. 4Subsea is a company in the Subsea 7 Group. More info at www.4subsea.com.

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