WindMETER

Wind Blade Monitoring System
Tri-Channel Interrogator

Fiber optic technology
WDM interrogation
Simultaneous acquisition rate up to 100 S/s
Built-in calibration
Long term accuracy
Sensors immune to fatigue
Sensors immune to lightning
Sensors immune to EMI/RFI

Empowering Wind Turbine Monitoring

WindMETER system is a reliable monitoring solution specifically designed to monitor wind generator blades. The system consists of a low consumption optoelectronic interrogator suitable for operation over extended temperature range and a set of Fiber Bragg Grating (FBG) strain and temperature sensors.

Components

- Interrogator
  The interrogator is installed inside the rotor hub, being each optical channel allocated to one blade.
  The WindMETER interrogator is based on the 100 S/s acquisition rate BraggMETER core, ruggedized for outdoor applications with IP65 stainless steel enclosure and fanless operation. It uses a real-time operating system for consistent and deterministic results. A unique swept tunable fiber laser cavity ensures the interrogator long term reliability.
  The interrogator uses a built-in reference element that enables the auto-adjustment of all measured values each 10ms.
- Sensors
  The WindMETER System uses strain and temperature sensors based on Fiber Bragg Grating (FBG) technology. The standard sensor network comprises 4 strain sensors and 4 temperature sensors per blade. The system can, however, be expanded as each optical channel can accommodate a larger number of sensors, depending on the specific measurement range that each sensor will be subjected. Sensors are completely passive and feature inherent insensitivity to environmental induced drift, EMI/RFI lightning and electrostatic sparks. They consist on FBG embedded in GFRP (Glass Fiber reinforced Polymer) with a polyurethane rubber encapsulation for mechanical protection.

System Integration

HBM FiberSensing WindMETER interrogator has Ethernet interface allowing their remote connection to any standard PC through Ethernet. The interrogator can be fully controlled using TCP/IP commands.
User friendly software – WindMONITOR – is available to be installed on the control PC for measurement configuration and diagnosis.
Optionally, the interrogator can be configured with Profibus, Can or Modbus communication protocol.

Applications

Output data from WindMETER system can be computed for both control and monitoring.
These include:

- Individual pitch control
- Rotor imbalance assessment
- Blade design optimization
- Preventive maintenance
- Post repair evaluation
- Ice detection

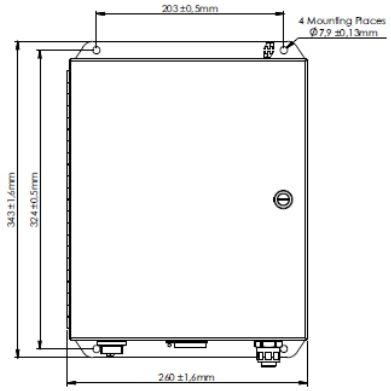
Quality

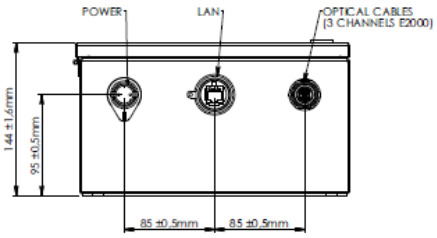
All HBM FiberSensing's processes are strictly controlled from development to production. Each product is subjected to high standard performance and endurance tests, individually calibrated and checked before shipping.
HBM FiberSensing, S.A. concentrates all optical sensing activity of HBM and is an ISO 9001:2008 certified company.

Specifications

	Interrogator	Strain Sensor	Temp. Sensor
Range	80 nm (1510 to 1590)	±5000 µm/m	-20 to 80 ºC
Sensitivity (typical)	-	830 µm/m/nm[5]	33 ºC/nm[5]
Resolution	1.0 pm	1 µm/m	0.1 ºC
Absolute accuracy	±10 pm	±8 µm/m	±1 ºC
Sensors per channel[1]	8 (standard)	4	4
Optical channels	3 (in parallel)[2]	-	-
Central wavelength	-	HBM FS bands	HBM FS bands
Sample rate	100 S/s	-	
Optical detection	Linear (programmable gain)	-	-
			-
Dynamic range[3]	25 dB		-
Laser Source			
Optical output power	-3 dBm		
Linewidth	< 500 MHz	-	-
Optical insulation	> 70 dB		
Connectors			
Optical	E2000/APC		
Electrical	Bulgin PX0802 - Body, Chassis	-	-
Communication	Bulgin PX0833 – Socket, Buccaneer, RJ45		
Control			
Interface commands	Ethernet (TCP/IP) SCPI (ASCII textual strings)[4]	-	-
Communication protocol	Canbus, Profibus or other upon request	-	-
Environmental			
Operation temperature	-20 to 60 ºC	-20 ºC to 80 ºC	-20 ºC to 80 ºC
Relative humidity	< 100%	< 100%	< 100%
Mechanical			
Dimensions (w x h x d)	343x260x144 mm	130x20x4.5 mm	130x20x4.5 mm
Mounting	4 screws M6	-	-
Enclosure	Stainless steel	-	-
Weight	8 kg	40 g	40 g
Power			
Voltage	24 VDC	-	-
Consumption	20 W		

Mechanical Drawing





Ordering Information

Tri Channel Interrogator E2000/APC

P/N
602 236 100 308

WindMETER Strain Sensors

P/N
606 217 100 202

WindMETER Temperature Sensors

P/N
606 317 100 202

Pre-defined wavelengths:

Sensor Code	Central Wavelength
Strain - WMSG1	1517.5 nm
Strain - WMSG2	1537.5 nm
Strain - WMSG3	1557.5 nm
Strain - WMSG4	1577.5 nm
Temp. - WMTS1	1527.5 nm
Temp. - WMTS2	1547.5 nm
Temp. - WMTS3	1567.5 nm
Temp. - WMTS4	1587.5 nm

[1] Number of sensors per channel may increase considering lower range/sensor.
[2] 1 or 4 channels available upon request.
[3] Considered as the ratio between the optical power emitted at an optical channel and the minimum detectable optical power reflected by a fiber Bragg grating.
[4] Standard Commands for Programmable Instruments.
[5] Typical values.

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