WHITE PAPER

Wind Turbine Monitoring System

Continuous monitoring of wind turbine strain gages at NREL, The National Renewable Energy Laboratory

ACCUMETRICS INC.
A PCB GROUP COMPANY

030515-NR

Visit us online at www.accumetrix.com ☎ Toll-Free 888-684-0012 ☎ 518-393-2200

Application: Wind Turbine Monitoring System

Continuous monitoring of wind turbine strain gages at NREL, the National Renewable Energy Laboratory.

Industry: Power

Product: AT-7000

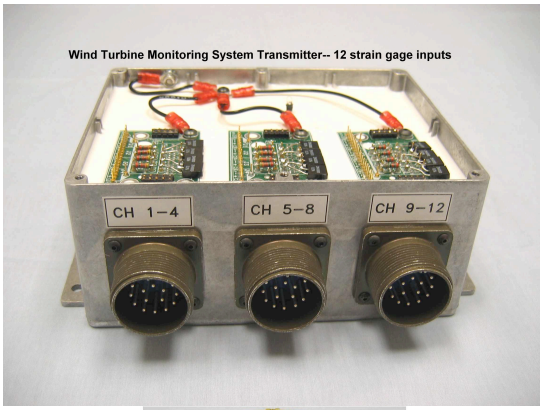
Parameters measured: Strain (Eight ¼ bridge strain gages)

The National Renewable Energy Laboratory needed to monitor eight quarter bridge strain gages, and chose Accumetrics' AT-7000 digital telemetry system. The system provided excitation for the sensors, as well as on-rotor amplification, anti-alias filtering, and digitizing of the signals. The on-shaft digitizing aided in a low susceptibility to EMI, and a robust way of transferring data to the remote receiver as a serial high speed data stream. Given the size of the rotor and the relatively low RPM, the transmitter circuitry was housed in a simple but rugged rectangular box. A series of insulated standoffs provided the mounting for a circular wire construction rotating induction coil, while the stationary pickup coil was constructed from segments of copper tubing. Each of the eight channels was provided with on-the-fly shunt calibration capability, allowing a known bridge imbalance to be applied to verify signal levels.

The system sampled each strain gage input at 5800 samples per second.

Benefits of the solution:

- Dependable high bandwidth digital telemetry—no interference from EMI, no data drop-outs.
- Induction powered for continuous use.
- Highly accurate, dependable, and noise-free strain gage data:
- Precision instrumentation amplifiers are used before digitizing on the rotating shaft
- High speed sampling provided to ensure reconstruction of full spectrum of desired bandwidth
- Wireless access (instead of troublesome slip rings) to rotor sensor data.
- Single digital data stream transmission of multiple channels (eliminating the need for multiple transmitter/receiver electronics and tuning)



AT-7000 system for monitoring 12 Strain Gages (for a different wind turbine generator application)

The above left picture shows a relatively small transmitter assembly, with three Amphenol input connectors for a 12 channel system. On the reverse side of the enclosure is located a coaxial connector for an RG-58 connection to the rotating stand-off wire transmitter coil. The above right picture shows the pickup induction power/data coil. A NEMA style Receiver is also shown.

The AT-7000 multichannel system can measure RTD's, Thermocouples, Strain Gages, Pressure transducers, as well as differential Voltages (and Current shunts).

What are divisions of PCB Piezotronics?

PCB Piezotronics, a member of the PCB Group families of companies, has five major divisions, all of which offer targeted sensor technologies. These divisions are supported by an active outside direct sales force of Field Application Engineers, as well as international direct sales offices throughout the world. Individual PCB Piezotronics divisions, locations and their primary product specialties include:

PCB PIEZOTRONICS INC.

Depew, NY, USA - www.pcb.com – Piezoelectric, ICP®, piezoresistive & capacitive pressure, acoustic, force, torque, load, strain, shock & vibration sensors.

AEROSPACE & DEFENSE
A PCB PIEZOTRONICS DIV.

Depew, NY, USA - www.pcb.com/aerospace – Sensors & Instrumentation for aerospace & defense applications, including air and spacecraft testing.

AUTOMOTIVE SENSORS
A PCB PIEZOTRONICS DIV.

Farmington Hills, MI & Depew, NY, USA - www.pcb.com/auto – Sensors & Instrumentation for automotive testing, including modal analysis; NVH; component durability; powertrain testing; vehicle dynamics; safety and regulatory testing.

IMI SENSORS
A PCB PIEZOTRONICS DIV.

Depew, NY, USA - www.imi-sensors.com – Industrial vibration sensors, bearing fault detectors, mechanical vibration switches, panel meters, cables & accessories for predictive maintenance and equipment protection. Also providing pressure sensors and accelerometers for precision measurement requirements in the power generation and energy industries

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

Farmington Hills, MI & Provo, UT, USA www.larsondavis.com – Precision microphones, sound level meters, noise dosimeters, audiometric calibration systems.

PCB LOAD & TORQUE
A PCB PIEZOTRONICS DIV.

Farmington Hills, MI, USA - www.pcb.com/loadandtorque – High quality, precision load cells, wheel force transducers, torque transducers, telemetry systems, and fastener torque-tension test systems.

ACCUMETRICS INC.
A PCB GROUP COMPANY
409 Front Street, Schenectady NY 12305 USA
Phone 518-393-2200 ■ **Fax** 716-684-0987
Email telemetry@pcb.com ■ **Website** www.accumetrix.com