



Wireless Telemetry for Wind Power Testing



As the growth in wind energy continues, the average size and capacity of wind turbine generators is also increasing, stretching designs and materials to new unproven limits.

With this increase in size comes an increase in the cost of operation, and in particular the cost of repairs, downtime and unscheduled maintenance. Reliability during operation will become increasingly important.



The effective condition monitoring and early indication of maintenance is vital to avoid extensive damage to major components. This requires the development of a fundamental understanding of in-service failures, experimental and analytical techniques.

For efficient testing and product validation of rotating wind turbine components datatel offers specific wireless telemetry system solutions. They are reliably used under demanding operating conditions for both, onshore and offshore installations. Our telemetry equipment is successfully used for long term surveys (e.g. for field testing or in test rigs) or for temporary test (e.g. for troubleshooting).



datatel
TELEMETRY

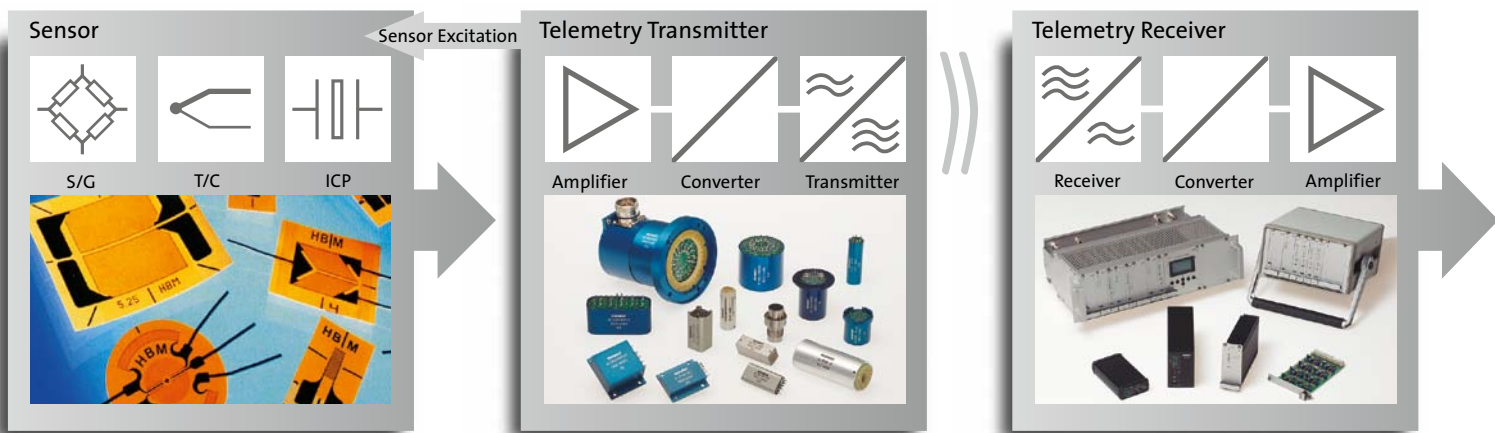
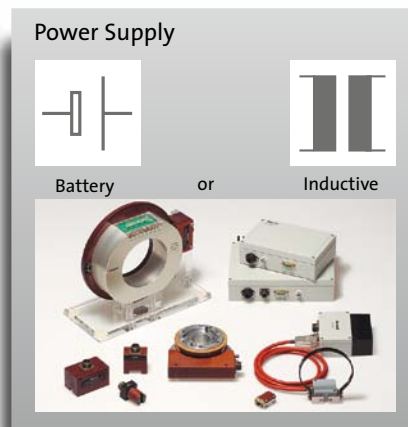
Wireless Telemetry for Wind Power Testing

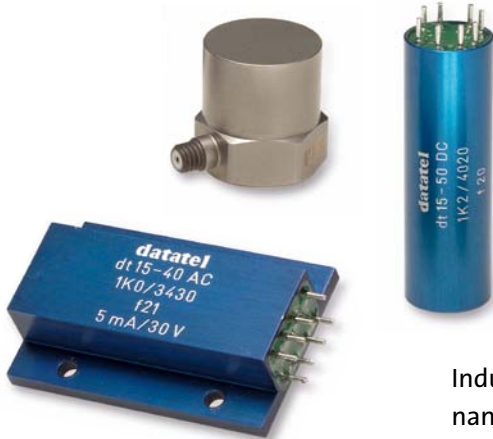
Product Profile

datatel telemetry products are the result of more than thirtyfive years of continuous user-oriented development and cover a wide range of rotating and reciprocating applications including wind power, aero- and industrial turbomachinery, aerospace, diesel engine, automotive, test stand, railroad and process industry installations. Systems have been delivered with capacities ranging from a single channel to several hundred channels in one installation. Miniaturised telemetry transmitters are available for all standard measurement sensors for static and dynamic strain, torque, force, temperature, pressure, acceleration, vibration, displacement etc. However, datatel is always ready to develop or modify a special transmitter for the customer's requirement, together with the associated receiver and signal conditioning.

Datatel telemetry uses state-of-the-art analog and digital technology. Even highly dynamic signals up to 50 kHz frequency response can be measured and transferred with excellent signal quality and accuracy. The data from each individual transmitter are transferred to the telemetry receiver unit at a selected radio frequency in the MHz range. The final accuracy of

the data is also, of course, dependent upon the performance of the sensors being used, but with datatel telemetry a measurement accuracy of $\pm 0.1\%$ FS can be achieved. In addition these modern telemetry systems feature helpful tools such as remotely controlled instrumentation diagnostic functions (e.g. online strain gage shunt calibration and auto-zero function, sensor 'open and short' detection, programmable gain, transmitter power supply and operating temperature monitoring) to check out in-situ the integrity of sensors, the associated wiring and the telemetry measuring chain. As a result of SMD, COB and Hybrid technology, combined with special module packaging and potting methods, these telemetry transmitters can accept operation in harsh conditions such as -40°C to $+125^{\circ}\text{C}$, g-loads more than 100.000 g, shock, vibration, oily and gaseous environments.





Telemetry modules for vibration measurement with ICP type accelerometers

Telemetry receivers are available with analog or digital output and can be connected directly to the preferred data acquisition system. Output signals are already filtered, amplified and calibrated. No additional signal processing of the measured data is needed.

The receiver units are available as compact, self-sufficient units. They are rugged and can be powered by AC or DC power supply. Alternatively for test stands and laboratory installations, receivers in modular 19" rack technology with mains power supply are standard.

All datatel telemetry transmitters can be powered either by battery or inductively. This dual power concept ensures the highest level of flexibility for a wide range of applications.

Battery supply can be used under the following conditions:

- Short operating times (several hours to a few days)
- Good accessibility
- Sufficient space
- Suitable for rotating or freely moving test objects.

Inductive power supply is maintenance-free and can be used under the following conditions:

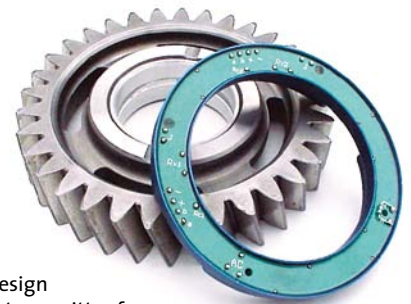
- Long-term measurements (over weeks, months or years)
- Poor accessibility
- Limited space requirements
- Suitable for rotating test objects even for very high rotating speed.

An inductive power supply works like a transformer and has a stationary and a rotating coil. The coil system is fed by a power generator. The antenna system for the data transmission is built into the rotor and stator coils. datatel can supply a wide range of ready-to-install standard or customer specified coil sets.

Customised Turnkey Solutions

datatel telemetry is based upon a highly-developed, modular electronics technology, supported by all the skills and resources necessary to design, manufacture and integrate complete, turnkey solutions to customer measurement requirements. This includes the design and fabrication of all special hardware needed for the application, plus the modification of

test components and the application of sensors (e.g. strain gaging services). Particularly important are custom transmitter carriers and inductive power coil/antenna assemblies, produced to suit the special requirements of any application. Hence the telemetry components are not merely 'tacked-on' to the machine under test but are fully integrated into the mechanical design so as to ensure secure, prolonged operation. For major test stands this provides virtually a permanent installation. Final system assembly, checkout and test is carried out at the datatel plant whenever possible, but on-site support is always available.



Custom design telemetry transmitter for strain measurement in a gear wheel

The result is targeted custom-designed turnkey telemetry systems from a single source. The unusually wide range of services and technical support provided is beneficial for the test program and guarantees success even for the most sophisticated telemetry projects.

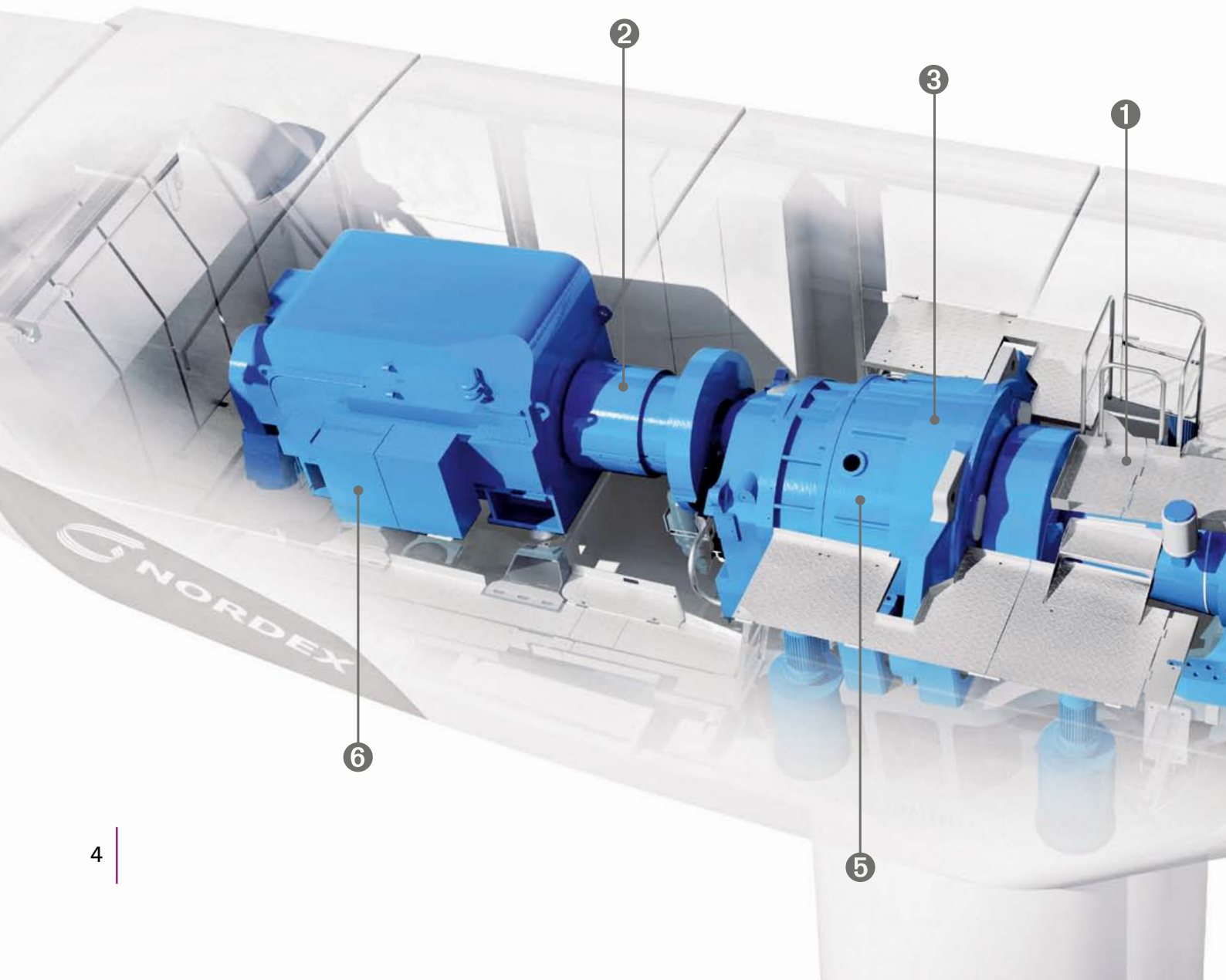
Telemetry Applications on Wind Turbines

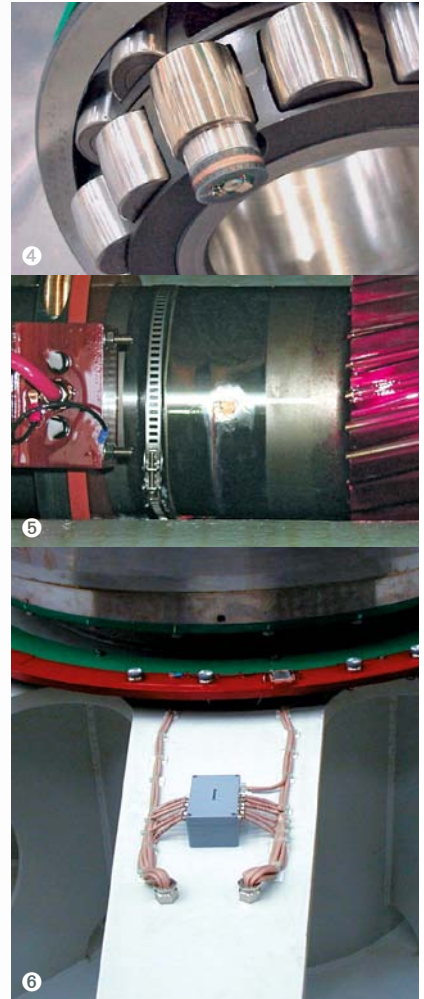
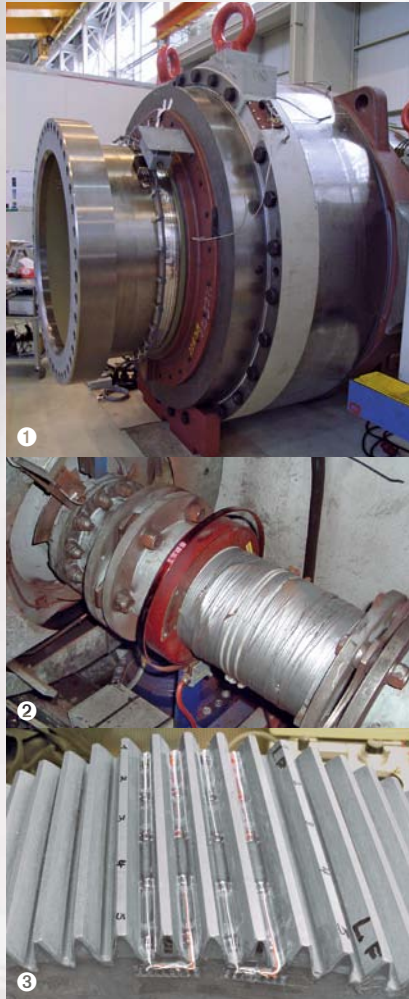
Telemetry places specific demands on the instrumentation technology used and offers a range of services including problem analysis and competent application engineering. During the system design phase we work in close co-operation with our customers and provide comprehensive technical support of which you can rely on.

We deliver a broad range of turn-key telemetry systems for the measurement of physical parameters on rotating components of wind turbines.

Even installations on very large rotor shaft or hub diameters are possible.

- Rotor Blade Testing
- Drivetrain Testing
- Gearbox Testing
- Generator Testing
- Research & Development
- Trouble Shooting & Diagnostics
- Condition Monitoring
- Onshore and Offshore Installations
- Test Rig Installations





- ① Rotor Shaft Torque and Bending Load
- ② Generator Shaft Torque and Bending Load
- ③ Gear Wheel Tooth Root Force
- ④ Roller Bearing Load
- ⑤ Gearbox Shaft Torque and Bending Load
- ⑥ Generator Rotor Temperature
- ⑦ Rotor Blade Strain and Vibration

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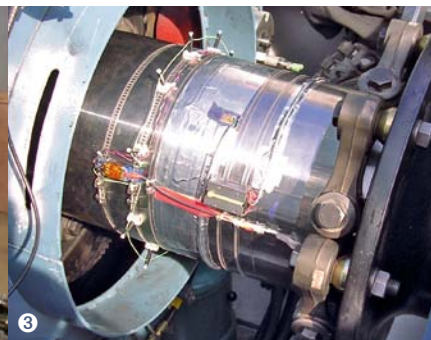
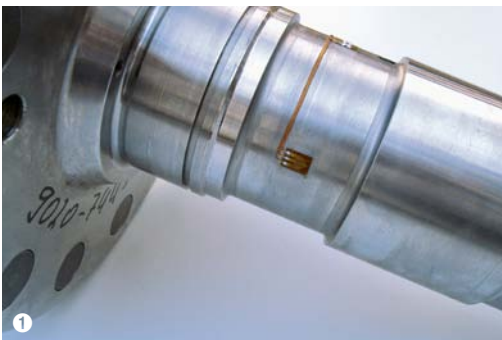
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Torque Measurement Solutions

Direct measurement of torque and torsional vibration are vitally important to better understand dynamic in-service loading of the wind turbine's gearbox and associated drive train. From most practical investigations it becomes apparent that changes in gearbox vibrations due to varying torque can be significantly higher than the changes due to impeding gear or bearing failures.

Troubleshooting gearbox problems in wind turbine applications requires the development of comprehensive experimental tools and specialised instrumentation for testing. For this purpose we provide highly flexible telemetry systems for custom-designed torque measurement.

- High level of flexibility to meet specific application requirements
- Use of existing shafts, couplings, flanges etc. of the machinery
- No modification of the drivetrain required
- Strain gauging directly onto the shaft
- Individual integration/adaption of the telemetry system
- Suitable for severe operating conditions (e.g. high speed, vibration, environmental temperatur etc.)
- For long term monitoring or temporary (short term) testing
- High signal bandwidth performance for torsional vibration surveys



Company Background

Telemetrie Elektronik GmbH (datatel) was founded in Hannover, Germany in 1976. The philosophy of providing expert advice to our customers coupled with the high performance, reliability and ease of use of the products have made the company into one of the leading manufacturers of telemetry systems Worldwide.



datatel telemetry systems have been setting new standards for the link between rotating or moving sensors and stationary data acquisition systems. Our team of experienced

employees is specialised in the design, development and manufacture of innovative turnkey solutions for telemetric measurements of all kinds. In addition, a wide range of service and support activities is provided.

datatel is represented internationally with a network of service and sales partners in Europe, Asia and North America.

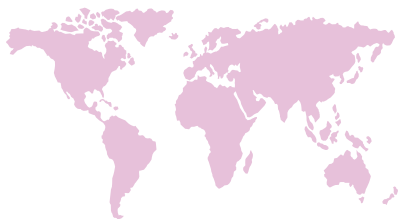


- ① Example of a strain-gauged shaft
- ② Load coupling for torque measurement on heavy-duty gas turbine test rig
- ③ Torque survey on a wind turbine generator shaft (short-term installation)
- ④ Instrumented fiberglass coupling for torque and torsional vibration measurement



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www.datatel-telemetry.com



Telemetrie Elektronik GmbH
Berliner Allee 42
D-30855 Langenhagen · Germany
Tel. +49(0) 511 97 83 96-0
Fax. +49(0) 511 97 83 96-16
sales@datatel-telemetry.de