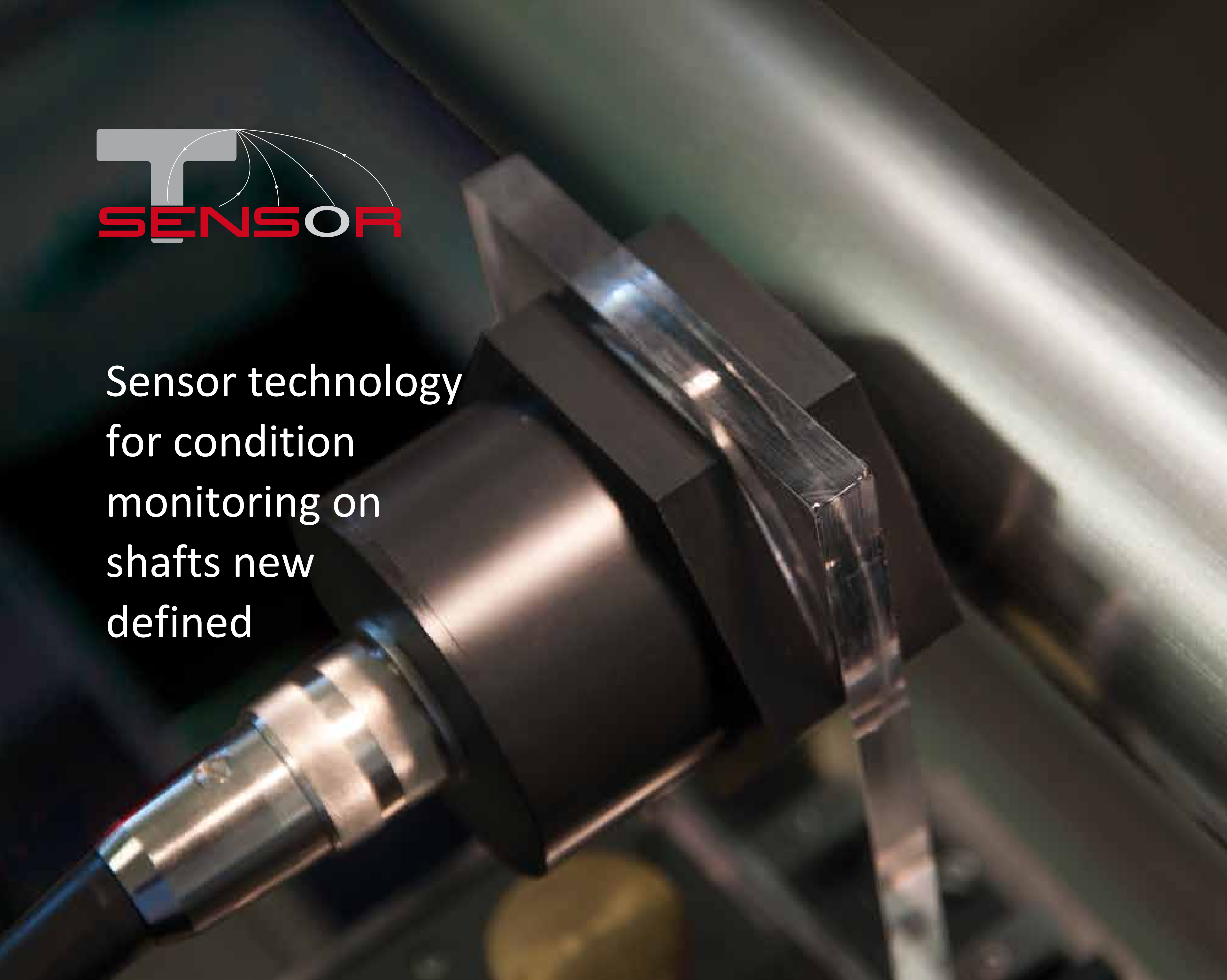


T SENSOR

Sensor technology for condition monitoring on shafts new defined

High Technologies for High Demands

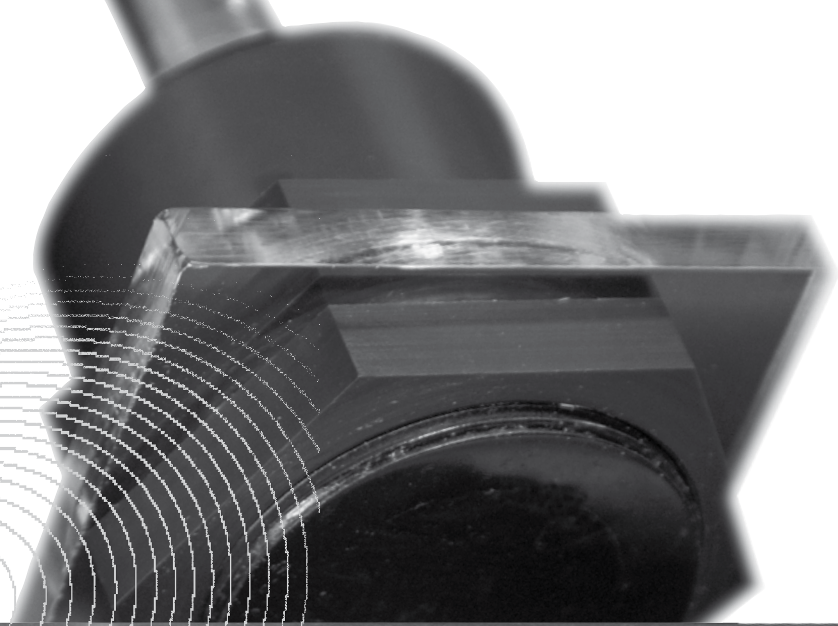
Functional Principle

The patented T-sensor does not require any treatment or any alteration of the measurement object. The sensor head consists of several inductances. The transmitter coil is fed by an electrical current of a constant frequency. The equidistant located receiver coils act as a passive part of the sensor. The detection of torque- or speed-dependent phase shifts between the input and the received signals are accomplished by an innovative sensor electronics. The underlying analysis software reduces drift and interference effects for instance caused by thermally driven effects or material-specific hysteresis effects.

Measurement of Torsional Load

The elastic and reversible deformation of a solid body is described by Hook's law. Any force applied on a deformable body manifests itself in a geometrical change in its dimensions. A torsion-loaded homogeneous and cylindrical-symmetrical body thus experiences a mutually deforming state, which develops along the tensile and compressive stress lines. This stress-induced deformation state causes a variation in the magnetic properties of the ferromagnetic material. In magnetic materials without any preferential direction (untreated axes made from steel and shafts without functional layer), a mechanical stress state leads to a decline of the magnetic susceptibility. A magnetic field applied to a ferromagnetic material will follow the electro-mechanical induced changes in the material.

Contactless Magneto-elastic Multifunction Sensors for Rotating Shafts



Measurement of the shaft speed

The interaction between an electrically conductive and moving body (axle/shaft) with an externally applied magnetic field leads to an induction of electrical currents in a material. These induced electric currents cause an induced magnetic field, which is superimposed on the applied field and thus changes in amplitude and phase. The change in amplitude or phase is proportional to the rotational speed of the wave in the magnetic field.

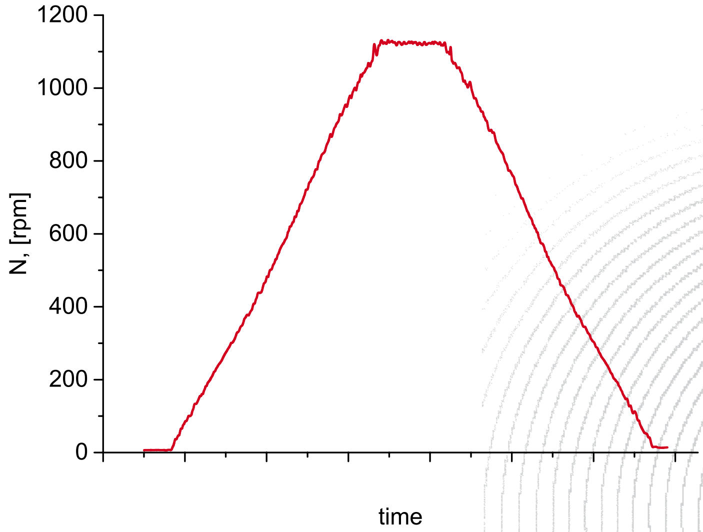
T-Sensor-Series (under licence of HZDR)

Only 1 Sensor detects 8 measures:

- **Torque**
- **Speed**
- **Direction of rotation**
- **Transmitted mechanical power**
- **Power fluctuation**
- **Torque shocks**
- **Displacement and dislocation***
- **Oscillations***

* customer related development is possible

Application Fields



Measurement made by T-Sensor of the continuous increase and decrease of the speed of a 300 mm steel shaft using VEM test bench.

Measurement of displacement and oscillations*

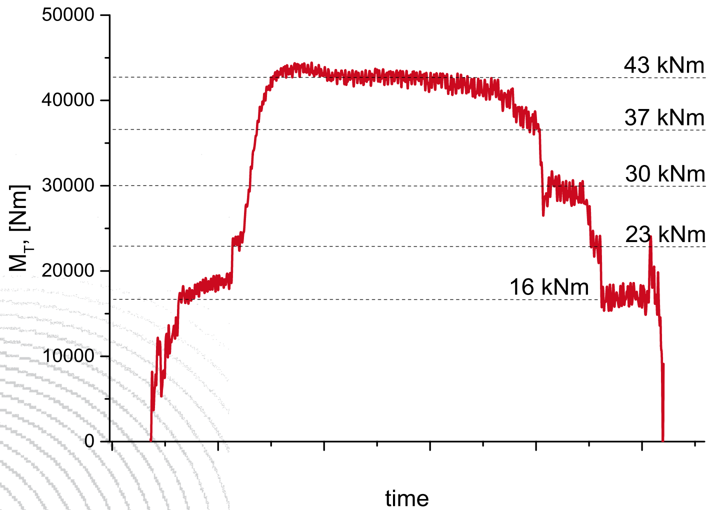
The relative change in the distance between the measured shaft and the sensor manifests in an increase or decrease of the applied signal intensity. This change can be evaluated as it is realized by conventional inductive proximity sensors. Since the external magnetic field excitation is provided by a temporally periodic current, the distance change or tilt of the measurement object can also be represented as electrical amplitude or phase change in the receiver coils. The increase of the excitation frequency as a function of the circulating frequency of the measuring object therefore also opens the way for the realization of an inductive oscillation analysis.

Picture: Navy Propelling screw,
Sergej Seemann © fotolia.de

Picture: VEM Dresden, VEM motor test bench
Dresdene-motor production

Application Fields

- Building materials industry
- Mining
- Chemical Industries
- Motor test bench
- Power generation turbines
- Rail-bound transport
- Wind turbines
- Shipbuilding



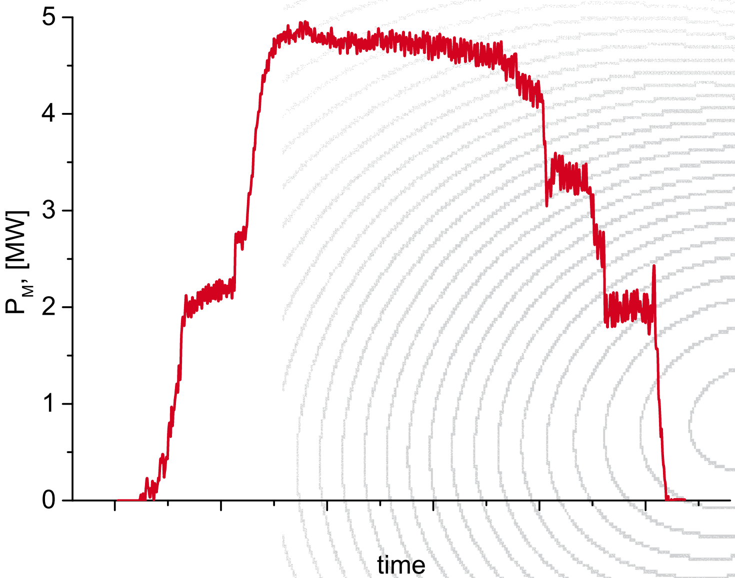
T-Sensor measured torsional load of a C 45 E steel shaft of D=300 mm diameter at VEM test bench

Picture: Wind mills Energy generation
hykoe © fotolia.de

Picture: Digger Mining industry,
H&C © fotolia.de

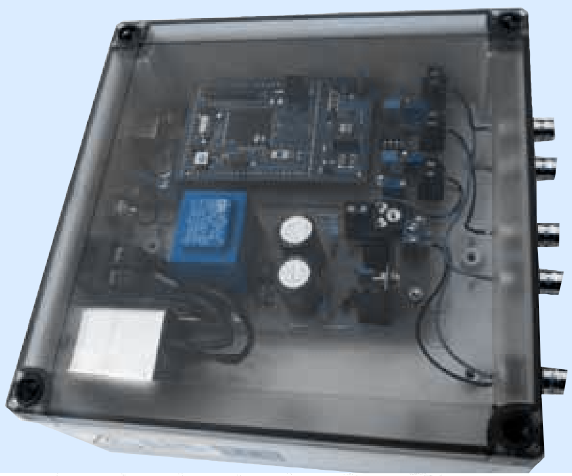
Picture: Kalkert/KIMA, Lafarge mill,
Building materials industry

Advantages of T-Sensor-Series: Well suited for retrofit applications



Measurement of the transmitted mechanical power up to 5 MW on a 300 mm steel shaft

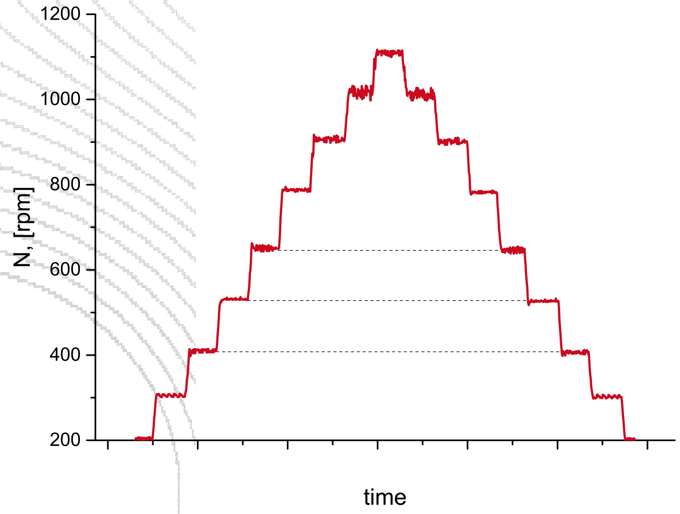
- Contactless principle
- Distance between sensor and shaft in the range of few millimeters
- Application in dirty, abrasive or aggressive environment
- No limitation with respect to the shaft diameter
- No magnetic hysteresis effects
- No temperature drift



Picture: Kolitsch/HZDRI, Contactless torque sensors and control electronics

Advantages of T-Sensor

- few installation/setting parameters (sensor distance and shaft material)
- simultaneous real time registration both of direct measured variable (torque, drive, direction of rotation, vibration, and dislocation) and
- derived measures (transmitted mechanical power, power fluctuations or efficiency)
- Highly resistant against electromagnetic disturbances
- Customer specific size and shape solutions



Hysteresis-free measurement of the gradual increase and decrease of the speed on a 300 mm steel shaft

Picture: Kolitsch/HZDRI, Contactless torque sensor installation at 50 000 Nm torque measurement of an big axle drive shaft

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Cover photo: Kolitsch/HZDRI, Contactless torque sensor and rotating shaft