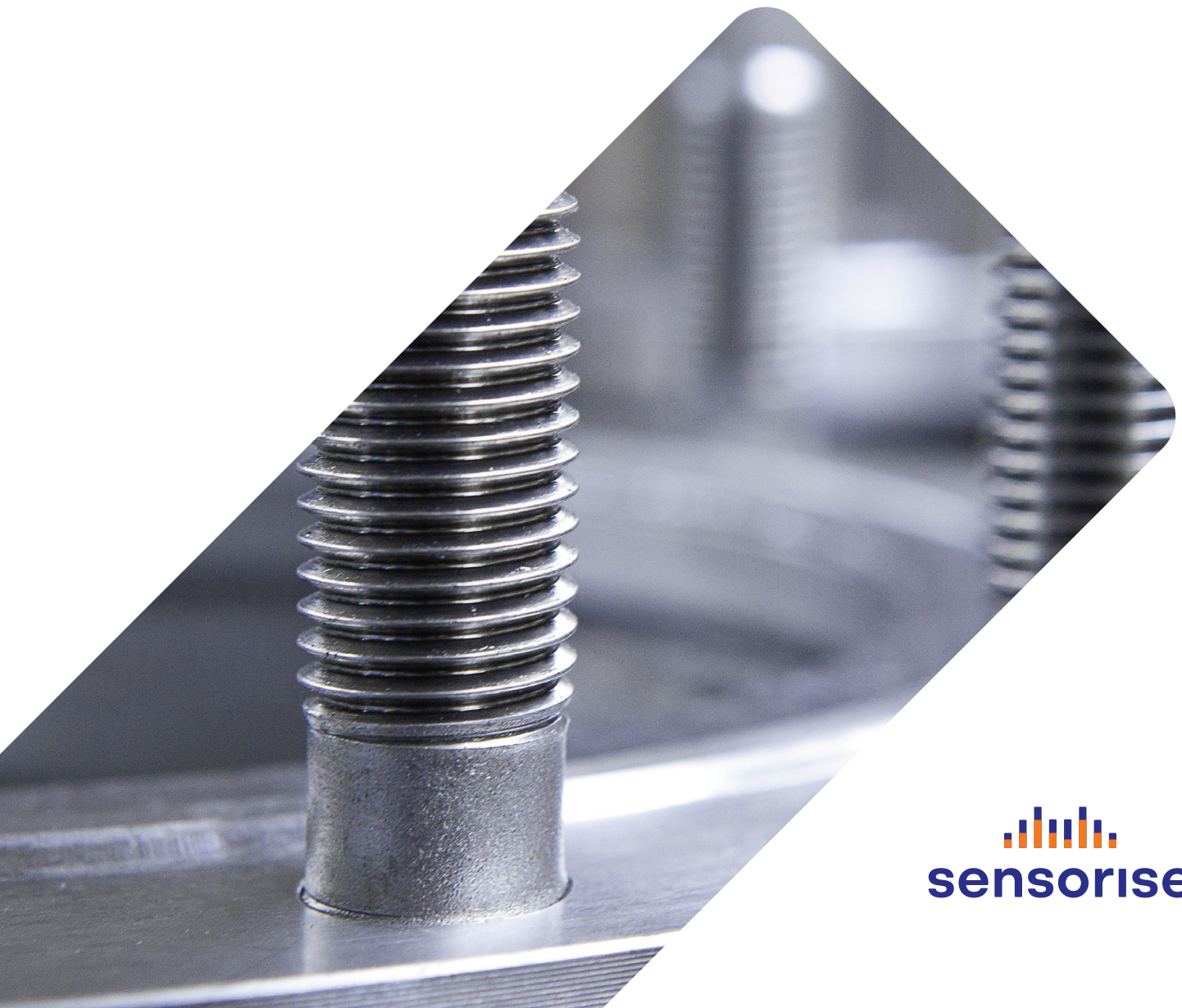


# Sensorise SmartScrew System

The Sensorise SmartScrew System is a complete solution for the continuous monitoring of screws and bolts. The system includes Sensorise SmartScrews, SmartBox, and SmartAnalytics.



## **SmartScrews:** easy installation

SmartScrews are mounted like regular screws and exhibit the specified mechanical properties of normed screws – making retrofitting effortless.

Sensorise SmartScrews are compatible with most signal conditioners on the market and are connected to the SmartBox, where signals are analyzed and distributed to the data center.

## **SmartBox: data in** the right amount

The SmartBox is an edge computing device that collects signals from SmartScrews, analog- and digital inputs, IO-Link, and fieldbus. The SmartBox preprocesses the data and forwards it to data warehouses for storage or analysis.

Depending on the application, the data transmission can be wired or wireless, as well as digital or analog. The sampling rate is adapted to each application to guarantee a stable data rate and to avoid digital waste.

## **SmartAnalytics: info** anytime, anywhere

The Sensorise team specializes in analyzing time series data, extracting meaningful information from raw sensor data, and building application-specific solutions. We cover a wide range of industrial applications: from energy generation to civil engineering to space travel – the possibilities are infinite. Solutions are deployable on-site or in the cloud.



## Installation, configuration and documentation

The installation process of screws and bolts is crucial to their long-term functionality. Typically, four or eight SmartScrews are used in circular flanges – independent of the total amount of bolts in the flange. Use the SmartScrew System to configure the amount and installation order in the flange to guide the crew on site. It is possible to connect your tool wirelessly to the SmartScrew System (WLAN or Bluetooth) to support the exchange of installation parameters in both directions. This enables a homogeneous distribution of preload across the flange, based on a direct strain measurement on the fastener.

### Instant information about pre-tension

Even load distribution across a flange is critical for flawless operational life. But the environmental conditions, as well as qualification of personnel, influence the quality of screw connections.

**Benefit:** Instant access to actual pre-tension in screws – independent of tool, qualification, or weather.

### Thorough process documentation

Did all go according to plan? How many different tools were used?

**Benefit:** The elimination of guesswork thanks to real data from SmartScrews in combination with tool data – data that's independent of the tool and in the format you require.

## Preload monitoring

A high level of pretensioning force increases the fatigue limit of fasteners. Maintaining a high preload is therefore a prerequisite for a long operational life of machines and equipment. This requires recurring inspections that are often visual and can usually only indicate broken bolts, but not necessarily a loss of preload. Re-tightening is not advisable as the static friction between nut and bolt might be higher than the required torque, resulting in a damaged fastener.

Since the Sensorise SmartScrew System measures the load directly and continuously, the operator gets a complete picture of the state of the preload.

A decreasing signal indicates a loss of preload, either caused by sudden failures, fatigue cracks, or broken nuts. An increasing signal is an indicator of broken screws or bolts in the SmartScrew's vicinity in the flange, as the SmartScrew has to carry the broken bolt's load as well.

By setting simple thresholds and alarms, spare parts can be ordered, and maintenance scheduled ahead of time.

### Detect broken screws and bolts

The detection of lost or loosened bolts, fatigue cracks, or overloaded screws is simple with the Sensorise SmartScrew System.

**Benefit:** Increased operational safety and decreased maintenance costs.

### More measurements with less effort

Strain gauges are commonly used to verify FEM simulations but are difficult to apply outside the lab. Replacing gluing strain gauges on bolts with SmartScrews enables measuring load changes of 0.1% (and less) of pre-tension.

**Benefit:** SmartScrews simplify data gathering, meaning more measurements with less effort.



## Dynamic loads

Dynamic loads are superimposed on the preload and caused by external forces. Since fasteners are often located in the flux of forces, the dynamic signal component contains valuable information not only about the screw or bolt, but also about the flange and the components attached to it.

The SmartScrew System is especially well suited to analyse frequencies below 10 Hz, although the upper-frequency limit is only determined by the signal conditioner. This complements other vibration sensors which are often suited for higher frequencies.

### Detect structural anomalies

Steel frame structures are flexible and deform under load, leading to (fatigue) cracks in beams and joints.

SmartScrews can monitor slight changes over time and detect anomalies early on.

**Benefit:** Preemptive measures are made possible and structural damage is avoided.

### Decrease the mass of rotating parts

The energy generated by a wind turbine increases to the power of two of the rotor diameter, while the mass increases to the power of three.

**Benefit:** SmartScrews mean lighter rotating parts with smaller safety factors, plus real-time static and dynamic load data.

### Continuous rotor blade monitoring

Equipping the blade flange with the Sensorise SmartScrew System enables wind turbine operators to monitor the blade bolts and flange, plus analyze the blade's dynamic behavior.

**Benefit:** Decreased maintenance costs and longer operational life.

### Manage and extend equipment life

Sensorise replaces strain gauges with SmartScrews. Located in the flow of force, all acting static and dynamic forces are transmitted from rotor tip to foundation.

**Benefit:** No more after-the-fact structural investigations and measurements.

## Our partners



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