



Sensorise Smart Screw System S⁴

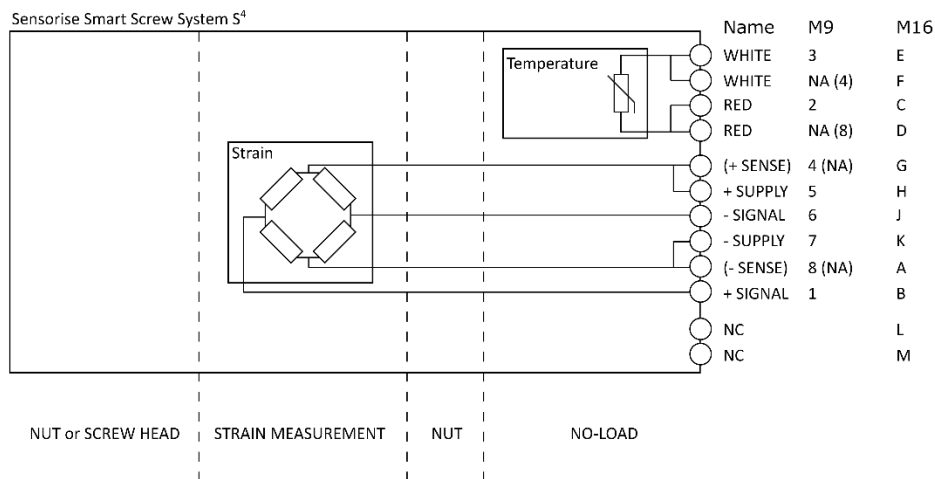
Features

- Strain measurement via bridge-circuit
- Measurement of static and dynamic loads
- Temperature measurement via RTD
- Connectivity via M9 or M16 connectors
- Measurement system resistant against humidity, oil, diluted acids and alkalis and many solvents

Applications

- Flanges
- Wind turbines
- Water turbines
- Vessel engines
- Large aggregates
- Oil and gas production
- Remote installations

Functional Block Diagram



General Discription

The Sensorise Smart Screw System S⁴ is a measurement system that is integrated into the thread of the screw or bolt.

The axial pre-tension of the screw and its temperature are provided as measurement signals via M9 or M16 connectors for simple and robust installation.

The S⁴ has been designed for harsh environmental conditions. The system is completely passive, eliminating the risk of failed active electronic components inside the mechanical part.

S⁴ screws can be mounted like regular screws and exhibit the specified mechanical characteristics of normed screws. This makes retrofitting of existing machines with S⁴ screws straightforward.

Screw and sensor elements are robust and highly integrated – the sensor becomes part of the screw during the manufacturing process and cannot be disassembled. The sensor system is very versatile and can be adapted to custom screw designs – contact Sensorise for your application.

S4 Specifications

Parameter		Units	Comments
TEMPERATURE			
Type	Pt100		Pt1000 optionally available
Resistance	100	Ohm	@ 20 °C
Range	-50 .. +100	°C	
Tolerance	Class B		
STRAIN			
Type	Integrated strain gauge		
Bridge resistance	350 .. 5000	Ohm	Resistance depends on screw dimensions and is marked on screw
Temperature coefficient	< 10	ppm	
Bridge supply voltage	5	V DC	
Amplifier sensitivity	0.2 .. 10	mV/V	Depending on active strain measurement length
MECHANICAL			
Connector type	M9 or M16		IP67, other connectors available upon request
Screw types	Hex Bolts Stud Bolts Treaded Rods		Custom designs available upon request
Connector placement	Nut-side		Head-side optionally available
Minimum thread	M20 or G 5/8"		Custom designs available upon request
Maximum screw length	Dependent on thread size		
No-Load distance	16	mm	Recess for connectivity

Certifications*

DIN EN ISO 9001 : 2015

AD-2000/WO

Pressure Equipment Directive 2014/68/EU

KTA 1401, AVS D 100/50

KTA 3201.1 und 3211.1

DNV GL

Bureau Veritas

RINA Certification

ASME Code Section III

KSB – NCA-3800 and 100CFR21

Emerson – NCA-4250

Kobe Steel Ltd. – NCR-Regulations

*more upon request

Absolute Maximum Ratings

Parameter		Units	Comments
Storage temperature range	-65 .. +150	°C	
Operating temperature range - dry	-40 .. +100	°C	Up to +150 °C available upon request
Operating temperature range - wet	-40 .. +60	°C	
Bridge supply voltage	10	V	

<p>Screw and mechanical construction must be properly grounded!</p> <p>! Take special caution when performing welding activities on the mechanical construction – avoid if possible! S4 screws must not be placed in the path of the welding current!</p>

Mechanical Mounting

Although S⁴ screws are designed for harsh environments, handle the system with care. Do not drop the screws as the connector or the thread might get damaged. Remove the protective sleeve right before mounting. The sensor inside the thread is well protected, however keep it away from sharp or abrasive objects that could reach the bottom of the thread. Do not force the screw into its hole and avoid touching the sides of the holes, especially with sensor-equipped tensioning bolts. Mount the S⁴ screw like a regular screw using torque wrenches or hydraulic tools. Do not exceed recommended pre-tension of the screw as specified by the screw manufacturer.

Electrical Connectivity

Connect the screw with standard sensor cables to the measurement equipment. Shielded cables are recommended for cables longer than 10 m and environments with high electromagnetic interference, e.g. close to electric motors or power electronics. Protect your measurement equipment from electromagnetic discharges, e.g. lightning strikes in outdoor applications taking appropriate measures.

Signal Amplification and Data Acquisition**TEMPERATURE**

Many data acquisition devices offer inputs for RTD measurement. S⁴ screws support 2-, 3- and 4-wire measurement. For highest precision, especially when using long cables, 4-wire measurement is recommended.

STRAIN

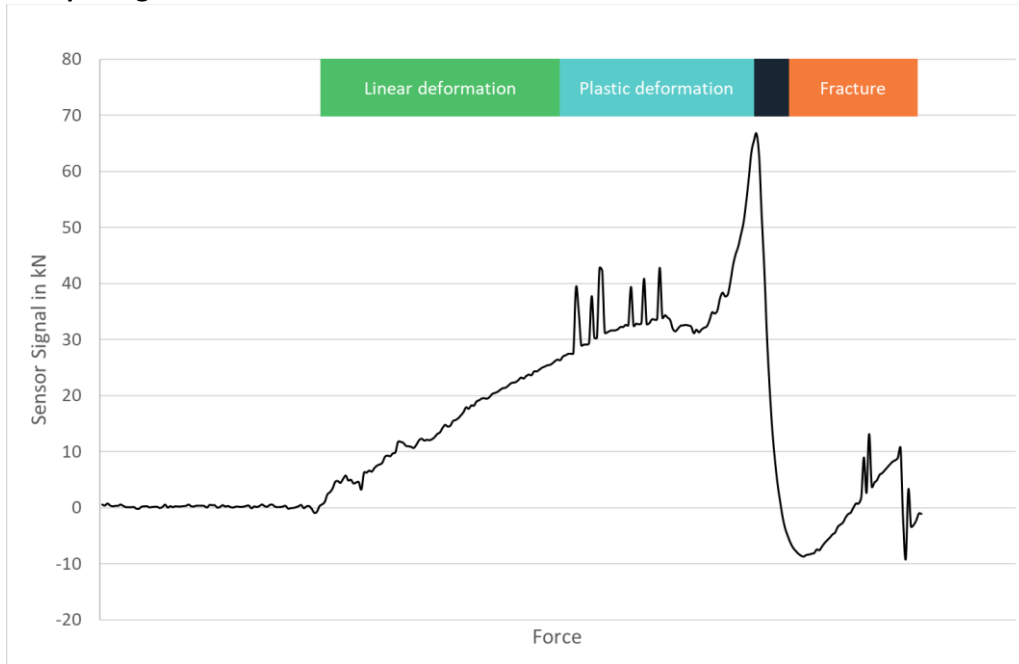
S⁴ screws are compatible with most industrial strain gauge amplifiers. The recommended bridge supply voltage is 5 V DC. 4- and 6-wire measurement is supported. For highest precision and EMC compatibility, 6-wire measurement is recommended. To effectively filter out 50 Hz noise, a cut-off frequency of 20 Hz or lower is recommended. If you expect higher frequencies (e.g. due to machine vibration) to be present, amplifiers with higher cut off-frequencies can be used. Taring to mid-range (12 mA for a 4..20 mA output signal) is recommended for later software-temperature compensation.

Calibration and Temperature Drift

S⁴ screws are delivered non-calibrated as a standard. To detect screw failure (lose nuts, cracked screw), taring the amplifier after tightening and setting thresholds for a (relative) value change is sufficient.

Due to the sensor element being distributed over the lengths of the screw, temperature drift is possible and can not be compensated completely inside the S⁴ screw. It is at the user's discretion to compensate for temperature drift with the help of the temperature signal in software.

Typical Output Signal for Strain



Additional Products and Services

Sensorise supports your applications from sensor to cloud! Screws and bolts, amplifiers, industrial data acquisition, cloud connectivity and storage are available as well as a seasoned team of experts to build custom data interpretation models.

Contact Information

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