Bolt load sensor family
S.Bolt XP

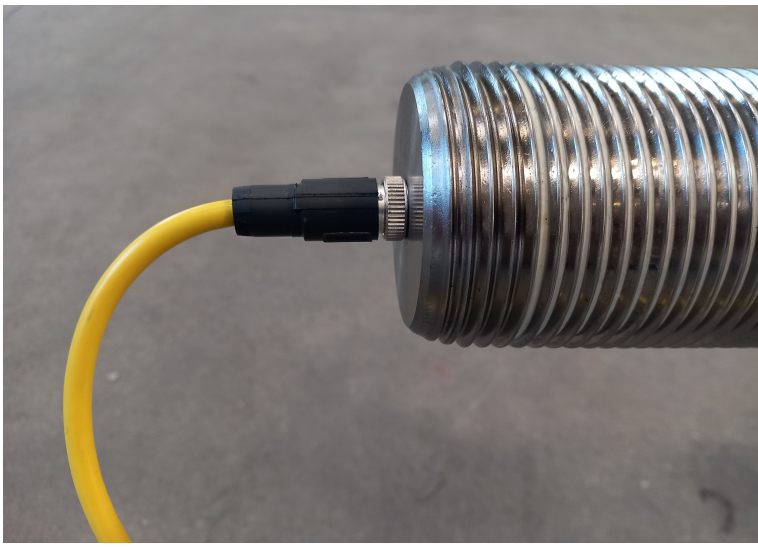
Introduction

The S.Bolt XP is a family of standard bolts with integrated sensors to measure static (preload) and superimposed dynamic (operating) loads.

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

S.Bolts are installed like regular and exhibit the specified mechanical characteristics of normed bolts. This makes retrofitting of existing machines with S.Bolts as simple as exchanging a regular bolt.

The sensor system is very versatile and can be adapted to custom bolt designs. Refer to the order codes or contact Sensorise directly.



S.Bolt XA
Axial load monitoring on M80 bolt

Specifications

Electrical

Strain gauge excitation system	4 wire	6 wire optional
Strain gauge excitation voltage	5 V DC	10 V DC max.
Strain gauge resistance (typ.)	1000 Ohm	Custom resistance 350..5000 Ohm on request
Output sensitivity (typ. for 10.9)	5.6 mV/V	ISO 376 calibration on request
Temperature coefficient	<10 ppm/K	

Mechanical

Connector Type	M12-A 4 pole	S.Bolt XA, S.Bolt XAR
	M12-A 8 pole	S.Bolt AB, S.Bolt AT, S.Bolt ABR, S.Bolt ATR
Supported bolt types	DIN 912 / ISO 4762	
	DIN 931 / ISO 4014	
	DIN 933 / ISO 4017	
	DIN 976	
	DIN 6914 / HV	
	DASt 021	
	DIN 2510	
	Custom expansion bolts	
Connector placement	Nut-side	
No-load distance	20 mm	
Minimum thread size	M24	S.Bolt XA, S.Bolt XAR
	M36	S.Bolt AB, S.Bolt AT, S.Bolt ABR, S.Bolt ATR

Specifications (continued)

Environmental

Operating temperature range - dry	-40 .. 85 °C	High-temperature on request
Operating temperature range - wet	-40 .. 60 °C	
Storage temperature	-65 .. 100 °C	
Maximum humidity	95 % non-condensing	
IP-rating	IP65	IP67 and IP69K available on request

Certifications

AD-2000/WO
Pressure Equipment Directive 2014/68/EU
KTA 1401, AVS D 100/50
KTA 3201.1 and 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
Other certifications on request.

! Before installing: Properly clean all threads (bolt, nut and tools) with a brush and suitable solvents (e.g. acetone or brake cleaner)!
Failure to might damage the electrical connection inside the thread! !

Mechanical installation

Although S.Bolts are designed for harsh environments, handle the system with care. Do not drop the bolts as the connector or the thread might get damaged. Remove the protective sleeve right before mounting. The electrical connections inside the thread (XA and AB) are well protected, however keep it away from sharp or abrasive objects that could reach the bottom of the thread.

Do not force the bolt into its hole and avoid touching the sides of the holes, especially with tensioning bolts. The nut must turn without resistance. Otherwise check for cause of obstruction (insufficient cleaning). Mount the S.Bolt like a regular bolt using the appropriate tool.

Torsioning insufficiently lubricated threads on hot-dip galvanized threads is not recommended.

Do not exceed the recommended pre-tension of the bolt as specified by the bolt manufacturer.

Electrical connection

Connect the bolt 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.

Strain measurement

S.Bolt XP are compatible with most industrial strain gauge amplifiers. The recommended bridge supply voltage is 5 V DC.

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 (e.g. 12 mA for a 4..20 mA output signal) is recommended for later software-temperature compensation, especially in applications with a high temperature range.

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

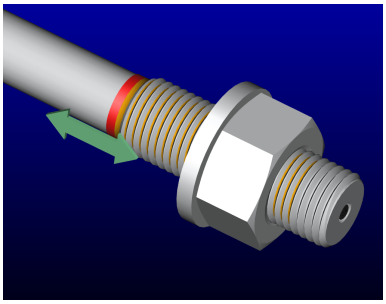
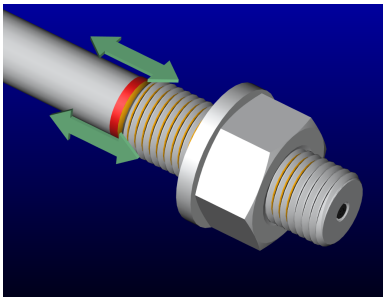
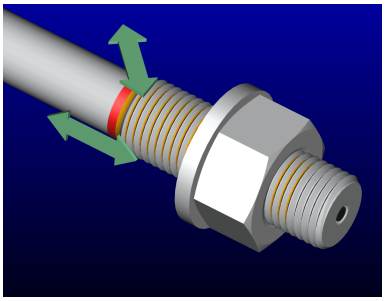
ISO 376 calibration is available on request.

Bolt and mechanical construction must be properly grounded! Avoid grounding loops.

! Take special caution when performing welding activities on the mechanical construction – avoid if possible! S.Bolts must not be placed in the path of the welding current! !

If welding can not be avoided, disconnect the signal conditioner from the S.Bolt before performing the welding.

S.Bolt XP types

Order code	S.Bolt XA	S.Bolt AB	S.Bolt AT
			
Load direction	Axial (bending compensated)	Axial (bending compensated) 2 axis bending	Axial (bending compensated) Torsion
Bridge type Connector	1x Full bridge M12-A female 1: + Excitation 2: + Signal axial 3: - Excitation 4: - Signal axial	3x Half bridge 666 Ohm M12-A female 1: + Excitation 2: Signal 0° 3: Signal 120° 4: Signal 240° 5: - Excitation 6: NC 7: NC 8: NC	2x Full bridge M12-A female 1: + Excitation axial 2: + Signal axial 3: - Excitation axial 4: - Signal axial 5: + Excitation tangential 6: + Signal tangential 7: - Excitation tangential 8: - Signal tangential
Temperature measurement	Optional	No	No
Robust version	S.Bolt XAR with reduced load	Not available	Not available
Minimum diameter	M24 regular thread M64 fine thread	M36 regular thread Not available for fine thread	M36 regular thread Not available for fine thread
Typical applications	Circular flanges Wind power Oil & Gas Hydro power	Wind turbine blade bolts Hydro power	Long torqued bolts

Special sensor element placements and configurations (e.g. torsion, axial load in multiple locations, ...) are available. Contact Sensorise with your application requests.

Although there is no upper limit of the thread size for S.Bolt XP sensors, we recommend the use of R.Ring M sensors for M72 and larger.

Sensorise supports you with installing and connecting the bolts to various endpoints. Contact sales with your application needs for a seamless integration into your existing infrastructure.