

torqXis - SFQ





Revision history

Revision	Date	Comment	Chapter
01	29.03.2010	New Version	All

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1 About this manual

This operating manual contains necessary information to safely use the torqXis - SFQ sensor system, referred to in the following as sensor.

The operator must make sure that this operating manual is read through by all persons assigned to install, operate or maintain the sensor and that they understand the manual.

Store the operating manual within reach of the sensor.

Please pass the safety instructions on to other persons as well.

The original instructions were prepared in German; all other language versions are translations of these instructions.

1.1 Signal words

The following signal words are used to bring your attention to dangers, prohibitions, and important information:

This signal word points out to an imminent danger that can cause serious injuries and even death.
This signal word points out to a possible danger that can cause serious injuries and even death.
This signal word points out to a possible danger that can cause slight
to serious injuries.
NOTICE
This signal word points out to a possible danger that can cause material damage.
A note without signal word draws your attention to application tips or especially important information when handling the sensor.

1.2 Safety symbols

The following safety symbols are used to bring your attention to dangers, prohibitions, and important information:



General danger



protection



Hot surface



Information



Suspended loads



Electric voltage



Danger of being pulled in



Electrostatic discharge sensitive component

1.3 Design of the safety instructions

The safety instructions of this operating manual is designed according to the following pattern:



- A = Safety symbol (see Chapter 1.2 "Safety symbols")
- **B** = Signal word (see Chapter 1.1 "Signal words")
- C = Type and consequence of the danger
- **D** = Prevention of the danger

1.4 Information symbols

The following information symbols are used:

- requires you to carry out an action
 - indicates the results of an action
- provides additional information on handling



2 Safety

This operating manual, especially the safety instructions and the rules and regulations valid for the operating site, must be observed by all persons working with the sensor.

In addition to the safety specifications mentioned in this operating manual, the general and also the local regulations on the prevention of accidents and on environmental protection should be observed.

2.1 EC directive on electromagnetic compatibility (EMC)

The sensor has been constructed in accordance with EC directive 2004/108/EC. During installation and connection of the electrical components, the relevant regulations have to be observed (for example screening, fuses).

Meeting all requirements for the entire system is the responsibility of the system's manufacturer. The EC declaration of conformity can be found in the appendix (see Chapter 8.5 "Declaration of conformity").

2.2 Dangers

The sensor has been constructed according to current technological standards and accepted safety regulations.

To avoid danger to the operator or damage to the machine, the sensor may be put to use only for its intended usage (see Chapter 2.4 "Intended use") and in a technically flawless and safe state.

• Before you begin working, inform yourself of the general safety instructions (see Chapter 2.6 "General safety instructions").

2.3 Personnel

Only persons may carry out work on the sensor if they have read and understood this operating manual.

2.4 Intended use

The sensor is constructed for attachment to machines in industrial environments to register measurements there.

The sensor is suitable for all industrial applications that do not fall under article 2 of the directive 2002/95/EC (usage restriction of certain dangerous materials on electro and electronic equipment). The sensor is no safety component within terms of the EC Machinery Directive.

The sensor registers the following indicators:

- Torques
- Radial forces
- Temperature

2.5 Guarantee and liability

Guarantee and liability claims are excluded for personal injury and material damage in case of

- Ignoring the information on transport and storage
- Improper use (misuse)
- Improper or neglected maintenance and repair
- Improper assembly / disassembly or improper operation
- operation of the sensor when safety devices and equipment are defective
- operation of a heavily soiled sensor
- modifications or reconstructions that have been executed without written approval of **WITTENSTEIN AG**



2.6 General safety instructions





3 Description of the sensor

The sensor is constructed for attachment to machines to register measurements there. The sensor registers the following indicators:

- Torques
- Radial forces
- Temperature

The sensor is designed as a compact ring, which is mounted between the machine bed and drive component.

The evaluation unit (EPU) is connected via the supplied cable. The connections are constructed in the protection class IP65.

The evaluation unit registers, processes and forwards the sensor data. For this it features the following communication interfaces:

- USB
- 12-pin socket (sensor connection)
- 19-pin system socket:
 - Supply
 - Analog interfaces (optional)
 - Digital interfaces (optional: RS232 / RS485; not possible with simultaneous integrated fieldbus connection)
- Fieldbus interface (optional):
 - EtherNet/IP or Profibus DP (optional, further protocols upon request; not possible with simultaneous RS232 or RS485 interface)



3.1 Sensor components overview

		Sensor components
	А	Sensor ring with:
		- Alignment marking
Alignment marking		- Connection for evaluation unit (EPU)
		- Type plate
EPU Type plate		
Fieldbus	В	Evaluation unit (EPU) with:
		 Connection for fieldbus (optional) 10 pin eacket (system)
		- 19-pin socket (system)
		- Button
3 LEDs		- USB-connection
System Sensor Button USB		

Tbl-1: Sensor components overview

3.2 Type plates

A type plate is attached to the sensor.

		Designation
A B	A	Ordering code (see Chapter 3.3 "Ordering code")
WITTENSTEIN AG	В	Article code
No.: A36X123456	С	Serial number
ć		

Tbl-2: Type plate sensor ring (sample values)

A further type plate is attached to the evaluation unit.





Tbl-3: Type plate, evaluation unit (sample values)

3.3 Ordering code



3.4 **Performance statistics**

Please refer to Chapter 8.4 "Technical specifications" for the maximum permitted forces and torques.

3.5 Weight

The average weights of the sensors are listed in table "Tbl-4". Depending on the features, the actual weight can deviate by up to 10 %.

Design SFQ	100	140	180
	1.25	2.0	4.0

Tbl-4: Weight [kg]



4 Transport and storage

4.1 Scope of delivery

- Check the completeness of the delivery against the delivery note.
 - ① Missing parts or damage must be notified immediately in writing to the carrier, the insurance, or WITTENSTEIN AG.

4.2 Packaging

The sensor is delivered packed in foil and cardboard boxes.

• Dispose of the packaging materials at recycling sites intended for that. Observe the locally valid regulations for disposals.

4.3 Transport



NOTICE

Hard impacts, for instance because of falling or hard dropping, can damage the sensor.

• Transport the sensor with appropriate care.

Specifications on the weights, refer to Chapter 3.5 "Weight". There is no special position intended for transporting the sensor.

4.4 Storage

Store the sensor in horizontal position and dry surroundings at a temperature of -40 °C to + 85 °C in the original packaging. Store the sensor for no more than 2 years.

For storage logistics, we recommend the "first in – first out" method.



5 Assembly

	NOTICE
	Loose or overloaded screw connections can cause damage to the sensor.
Ľ	 Use a calibrated torque wrench to tighten and check all screw connections for which a tightening torque has been specified.
-	
Δ	NOTICE
\wedge	NOTICE Strong tensions during mounting can damage the sensor and the whole machine.
	NOTICE Strong tensions during mounting can damage the sensor and the whole machine. • Use a centering device for the sensor installation (see Chapter 8.1.2 "Accessories concerning the machine bed").

3D models can be downloaded at www.wittenstein-sensors.com.

5.1 Preparations

- Clean / De-grease the following components with a clean and lint-free cloth and greasedissolving, non-aggressive detergent:
 - All fitting surfaces to neighboring components
 - Centering / Centering device
 - Machine bed
 - Drive component
- Dry all fitting surfaces to neighboring components in order to achieve the proper friction values of the screw connections.
- Check the fitting surfaces additionally for damage and impurities.

5.2 Aligning the sensor

5.2.1 Standard alignment



The standard alignment is suitable for a subsequent installation of the sensor into an existing system, because no mechanical adjustments are necessary. (View from the drive in the direction of the machine bed)



The sensor needs to be applied in such a way that the alignment marking is in the vertical and can be seen from above.



It needs to be taken into account on a standard alignment of the sensor that the application (e.g. gearhead) needs to be turned at an angle of 45° in comparison to an application without sensor. The reason for that is the arrangement of the fastening bores in the sensor.



5.2.2 Variable alignment



The sensor can be aligned to any angle. This angle needs to be known however and the shearing force results need to be converted using the formulas given below.

 $F_{x'} = F_x \cdot \cos\alpha - F_y \cdot \sin\alpha$ $F_{y'} = F_x \cdot \sin\alpha - F_y \cdot \cos\alpha$ whereas:

 $F_{x'}$ = converted/actual radial force in X-direction

- $F_{v'}$ = converted/actual radial force in Y-direction
- F_x = displayed/output shearing force in X-direction
- F_y = displayed/output shearing force in Y-direction

 α = offset angle in degrees





At any alignment of the sensor, it needs to be ensured that the hole circle for fastening the sensor has to be turned by the angle mentioned above with respect to the hole fastening of the gearhead.

5.3 Installing the sensor into the machine bed



• Slide the centering device all the way onto the sensor.



- Fasten the centering device with 4 screws on the sensor. Tighten the screws manually.
 - Screw sizes, refer to Chapter 8.1.1 "Assembly material concerning machine bed", table "Tbl-6".



- Insert the sensor into the machine bed with the aid of the centering device.
- Align the sensor according to the alignment marking.
- X = horizontal direction of force
- Y = vertical direction of force
- ① See chapter 5.2 "Aligning the sensor".





- Screw the sensor to the machine bed and tighten the screws with a torque wrench.
 - ① For bolt sizes and specified torques refer to chapter 8.1.1 "Assembly material concerning machine bed", table "Tbl-6".

• Loosen and remove the screws of the centering device.

Remove the centering device from the sensor.
This concludes the mounting of the sensor.



5.4 Mounting the drive component to the sensor

The mounting of a drive component is presented here using a SP⁺ standard gearhead **WITTENSTEIN AG** as an example. Individual assembly steps may deviate for other drive components.



- Place the SP⁺ gearhead into the sensor.
 - Respective gearhead sizes, refer to Chapter 8.2.1 "Assembly material concerning drive component", table "Tbl-8".
 - ① The drive component is centered by the centering diameter of the sensor ring.

- Screw the geamead screws with a torqu
 ① For bolt sizes an chapter 8.2.1 "As drive component
 This concludes the component.
- Screw the gearhead to the sensor and tighten the screws with a torque wrench.
 - For bolt sizes and specified torques refer to chapter 8.2.1 "Assembly material concerning drive component", table "Tbl-8".
 - This concludes the mounting of the drive component.



5.5 Installing the evaluation unit (EPU)









- Mount the evaluation unit with 4 screws (M6) to a location with the least possible vibration in your application (e.g. machine bed).
- Please observe the maximum signal cable length of 0.6 m.
- Connect the sensor ring with the signal cable to the evaluation unit.
- Depending on the model, connect a system cable, a bus cable or a USB cable to the evaluation unit.
 - ① You can find the cable assignment and electric specifications in Chapter 8.4 "Technical specifications".



6 Startup and operation

• Before you begin working, inform yourself of the general safety instructions (see Chapter 2.6 "General safety instructions").

Improper use can cause damage to the sensor.
Operational conditions and requirements for the surroundings:
- Unused sockets need to have their protective caps.
- The sensor is weatherproof.
 Strong UV rays, solvents, strong acids or alkalines can damage the and must be avoided.
 Because of the materials used, the operational temperature may not lie below -20 °C nor above +80 °C.
 For other conditions of use, please consult our Customer Service Department.
 Use the sensor only up to its maximum limit values, see Chapter 8.4 "Technical specifications".

6.1 Installing the software

The software is supplied on a CD.

- Insert the CD into the CD drive and start setup.exe. Local administrator rights are required for this.
- Select the installation directory.
- Start the software by the corresponding icon on the desktop.
 ① A detailed function description can be found in the corresponding help file of the software.

6.1.1 Overview of the software's functionalities

Configuration

- Zero point calibration
- Alarm thresholds
- Load values for load spectrums

Measuring functionality

- Visualizing mode for realtime operation
- Measurement of selected channels
- Triggered measurement
- Interval measurement
- Data export

6.2 Function test (LED)



- The evaluation unit is ready for operation when the status LED (A) lights up green.
 - ① A detailed function description can be found in the corresponding help file of the configuration software or atwww.wittenstein-sensors.com.

6.3 Zero point calibration hardware

Prerequisite: EPU is ready for operation (green LED lights)

- Hold the push button, to start the zero position calibrationp rocess.
 After validation, the LED light turns red (4 sec.).
- If the red LED light starts flashing (1 sec.), release the push button.
 - If the first validation process has been successful, the LED light starts flashing green (3 sec.)
- Press the push button once shortly and release it again.
 - If the process has been successful, the LED light stays green and the calibration process is carried out.

If there occurs a problem during the calibration process, the LED lights up red for 5 sec. to sign an error at the present stage of calibration. Therefore the calibration process has to be started once again, when the LED lights up green again.



7 Maintenance and disposal

• Before you begin working, inform yourself of the general safety instructions (see Chapter 2.6 "General safety instructions").

7.1 Maintenance work

The sensor requires little maintenance, because of its closed design and corresponding protection class. A regular visual inspection helps prevent damages though.

7.1.1 Visual inspection

- Check the entire sensor and all cables for exterior damage.
- Check whether the type plate is mounted and legible.

7.1.2 Checking the tightening torques

- Check the tightening torque of the fastening bolts on the machine bed and on the drive component.
 - ① You can find the prescribed tightening torques in Chapter 8.1 "Specifications on mounting onto a machine bed", table "Tbl-6" and in chapter 8.2 "Information on mounting the drive component", table "Tbl-8".

7.2 Startup after maintenance work

- Clean the outside of the sensor.
- Attach all safety devices.
- Do a trial run before releasing the sensor again for operation.

7.3 Maintenance schedule

Maintenance work	At startup	First time after 500 operating hours or 3 months	Every 3 months	Yearly
Visual inspection	Х	Х	Х	
Checking the tightening torques	X	Х		Х

TbI-5: Maintenance schedule

7.4 Disposal

Consult our Customer Service Department for supplementary information on disassembly and disposal of the sensor.

- Dispose of the sensor at recycling sites intended for this purpose.
 - ① Observe the locally valid regulations for disposals.

8 Appendix

8.1 Specifications on mounting onto a machine bed

The dimensions of the sensor system can be found in Chapter 8.4.3 "Installation dimensions of sensor system torqXis SFQ".

3D models can be downloaded at *www.wittenstein-sensors.com*.

8.1.1 Assembly material concerning machine bed

Assembly material and tools are not included in the scope of delivery.

Sensor size SFQ	100S	140S	180S
Screws centering	4 units M8	4 units M10	4 units M12
device	Length: 14 - 28 mm	Length: 16 - 28 mm	Length: 18 - 32 mm
Fastening screws	4 units M8 - 12.9	4 units M10 - 12.9	4 units M12 - 12.9
DIN EN ISO 4762	Length: min. 14 mm	Length: min. 16 mm	Length: min. 20 mm
Width across flats [mm]	6	10	14
Tightening torque [Nm]	37.3	73.4	126

TbI-6: Assembly material concerning machine bed

8.1.2 Accessories concerning the machine bed

Accessories are not included in scope of delivery.

Sensor size SFQ	100S	140S	180S
Centering device	SFQ100S-VOR-ZT	SFQ140S-VOR-ZT	SFQ180S-VOR-ZT
(Article code)	AC: A360000225	AC: A360000226	AC: A360000271

TbI-7: Accessories concerning the machine bed



8.2 Information on mounting the drive component

The dimensions of the sensor system can be found in Chapter 8.4.3 "Installation dimensions of sensor system torqXis SFQ".

3D models can be downloaded at www.wittenstein-sensors.com.

8.2.1 Assembly material concerning drive component

Assembly material and tools are not included in the scope of delivery.

Sensor size SFQ	Sensor size SFQ 100S		180S	
Gearhead type	SP ⁺ 100	SP ⁺ 140	SP ⁺ 180	
Fastening screws	4 units M8 - 12.9	4 units M10 - 12.9	4 units M12 - 12.9	
DIN EN ISO 4762	Length: 18 - 28 mm	Length: 22 - 28 mm	Length: 28 - 32 mm	
Width across flats [mm]	6	10	14	
Tightening torque [Nm]	37.3	73.4	126	

Tbl-8: Assembly material concerning drive component

8.3 Tightening torques for common thread sizes in general mechanics

The specified tightening torques for headless screws and nuts are calculated values and are based on the following conditions:

- Calculation acc. VDI 2230 (Issue February 2003)
- Friction value for thread and contact surfaces μ =0.10
- Exploitation of the yield stress 90 %

		Tightening torque [Nm] for threads											
Property class	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24
Bolt / nut													
8.8 / 8	1.15	2.64	5.24	8.99	21.7	42.7	73.5	118	180	258	363	493	625
10.9 / 10	1.68	3.88	7.69	13.2	31.9	62.7	108	173	265	368	516	702	890
12.9 / 12	1.97	4.55	9.00	15.4	37.3	73.4	126	203	310	431	604	821	1042

Tbl-9: Tightening torques for headless screws and nuts

8.4 Technical specifications

8.4.1 Performance statistics, sensor system torqXis SFQ

Sensor size SFQ	100S-		14	0S-	180S-		
	200-2k5	800-10k	500-4k5	1k5-14k	800-6k5	3k0-23k	
Torque	200	800	500	1500	800	3000	
[Nm]							
Radial force	2500	10000	4500	14000	6500	23000	
					10	10	
Lever arm (refer to definition) [mm]	39	39	51	51	46	46	
Torsional stiffness [Nm/arcmin]	1660	3600	5560	9580	8910	17240	
Stiffness [Nm/mm]	1025	1630	930	1910	1970	3190	
Life [h]	>20000	>20000	>20000	>20000	>20000	>20000	
Weight [kg]	1.25	1.25	2.0	2.0	4.0	4.0	
Temperature range [°C]	-20 – 80	-20 – 80	-20 – 80	-20 – 80	-20 – 80	-20 – 80	
Protection class	IP65	IP65	IP65	IP65	IP65	IP65	
Max. torque [Nm]	350	900	900	1800	1400	3500	
Max. radial force [N]	4000	11000	7000	15000	10000	26000	
Max. axial force [N]	20000	47000	21000	50000	40000	115000	

Tbl-10: Performance statistics, sensor system torqXis SFQ



Definition of the lever arm h

Drive (e.g. gearhead) - left Gear output / Application (e.g. machine bed) - right

8.4.2 Electric specifications EPU

Supply voltage	24 VDC +/-25%						
Power consumption without fieldbus module	max. 200 mA						
Power consumption with fieldbus module		max. 300 m	A				
Protection class	IP65 in plugged	IP65 in plugged-in condition or with corresponding protective caps					
Ambient temperature range		-20 °C to +80	°C				
Storage temperature range	-40 °C to +85 °C						
Analog interface	Parameter	Condition	min	Туре	max	Unit	
voltage	Output voltage	Load = 0 Nm / 0 N		5		V	
		Load = full scale		10		V	
		Load = -full scale		0		V	
	Output Current I _{out}	Source	20	40		mA	
	Output Current I _{out}	Sink	10	20		mA	
Analog interface	Parameter	Condition	min	Туре	max	Unit	
current	Output current	Load = $0 \text{ Nm} / 0 \text{ N}$		10		mA	
		Load = full scale		20		mA	
		Load = -full scale		0		mA	
	Last	I _{out} =020 mA			900	Ohm	
	Output voltage Supply voltage					tage	

Tbl-11: Electric specifications EPU



8.4.3 Installation dimensions of sensor system torqXis SFQ

3D models can be downloaded at www.wittenstein-sensors.com.



Tbl-12: Installation dimensions of sensor system torqXis SFQ

8.4.4 Dimensions EPU

3D models can be downloaded at www.wittenstein-sensors.com.



8.4.5 Pin assignment SFQ - EPU

The following plug combinations are possible.

- Sensor straight (see illustration)
- Sensor angular

P	Plug and socket	Cable color	
Pin	Description		
Α	+5V supply	Red	
В	GND	Green	
С	DMS channel 1+	White	
D	DMS channel 1-	Black	"• wo _ oo
E	DMS channel 2+	Yellow	
F	DMS channel 2-	Blue	
G	DMS channel 3+	Gray	
Н	DMS channel 3-	Brown	
J	Temperature+	Pink	Ţ
K	Temperature-	Violet	1
L	Clock-Sig SPI	Gray-pink	
М	Data-Sig SPI	Red-blue	Sensor
			\bigcirc





8.4.6 Plug assignment, system cable (19-pin)

The following plug combinations are possible.

- straight open
- angular open

Binder plug		Cable color	
Pin	Description		
Α	Vcc_in (24V)	White	×
В	DGND_in	Brown	
С	RS232RX_RS485+	Green	
D	RS232TX_RS485-	Yellow	
E	DGND	Gray	
F	DGND_in	Pink	T IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
G	Ana_out_GND_3	Blue	
Н	Ana_Out_3	Red	
J	Trigg_In_2	Black	
K	Dig_Trigg_RE	Violet	
L	Trigg_In_1	Gray-pink	
М	Ana_Out_2	Red-blue	
N	Ana_out_GND_2	White-green	
0	Ana_out_GND_0	Brown-green	_
Р	Ana_Out_0	White-yellow	
R	Ana_Out_1	Yellow-brown	
S	Ana_out_GND_1	White-gray	
Т	DIG_Out_1	Gray-brown	"
U	DIG_Out_2	White-pink	
			\sim

Tbl-14: Plug assignment, system cable (19-pin)

8.5 Declaration of conformity



EG-Konformitätserklärung EC-Declaration of Conformity

Wir / We, Anschrift Adress WITTENSTEIN AG Usserfeld CH-7214 Grüsch / Switzerland Tel: +41(0)81-300 10-33 Fax: +41(0)81-300 10-33 email: info@wittenstein-sensors.com

Erklären hiermit in alleiniger Verantwortung, dass die Erzeugnisse Hereby declare under our sole responsibility, that the products

Bezeichnung:	Sensorsystem torqXis
Designation:	Sensorsytem torqXis

Typ / Type: SFR004, SFR010, SFR025, SFR050, SFR110, SFR300, SFR500 SFQ060, SFQ075, SFQ100, SFQ140, SFQ180, SFQ210, SFQ240

Mit den wesentlichen Anforderungen der folgenden EG-Richtlinien und EN-Normen Comply with the principle demands of the following EC directives and EN standards

> 2004/108/EG Elektromagnetische Verträglichkeit (EMV) 2004/108/EG Electro Magnetic Compability (EMC)

EN 61000-6-4:2001 EMV Störaussendung – Industriebereich EN 61000-6-4:2001 EMC Emission – industrial environments

EN 61000-6-2:2001 EMV Störfestigkeit – Industriebereich EN 61000-6-2:2001 EMC Immunity for industrial environments

und den Prüfberichten übereinstimmt und somit den Bestimmungen entspricht. Die Sensorsysteme tragen das CE-Zeichen. and agree with the test reports and thus comply with the rules. The sensorsystems carry the CE sign.

Grüsch, 04.08.2009 Ort und Datum der Ausstellun Place and Date of Issue

Gerhard Horn trer/ G WITTENSTEIN AG Schweiz

al Manage Ge

Anna-Katharina Wittenstein Geschäftsführer/ General Manage WITTENSTEIN AG Schweiz

Ausgabedatum: 04.08.2009 Ersteller: FEC1 Dok.-Nr.: A36094-D000273

Rev. 01

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8.6 Complaint / Reshipment

Return to:

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Contact	
Company:	Tel.: Fax:
Street:	
City, zip code:	E-mail:
Country:	Date:
Product	
Article code:	
Serial number:	
Invoice number:	
Error description	