

LXT 970/971 Non-Contact Torque Sensor

1.0 Short Description

The LXT 970/971 series allows an easy and inexpensive torque measurement for test benches and production lines. With this torque sensor the effective torque on the gauge bar can be measured bi-directionally in real time both at rest and in rotation.

The sensor is delivered as a complete unit with corresponding connecting cable and key stones. The torque sensor is particularly characterized by its low price and high robustness.

2.0 LXT 970 / 971 Series

LXT Series		Max Rated Torque [Nm (ft-lb)]	Max Overload [Nm (ft-lb)]	Max Rotational [rpm]
Square Drive	Round Drive	bidirectional (+/-)	Ft-Lbs	Round / Square
LXT 970 2.5	LXT 971-2.5	2.5 (1.8)	5 (3.7)	5000 / 1000
LXT 970 5.0	LXT 971-5.0	5.0 (3.7)	10 (7.4)	5000 / 1000
LXT 970 7.5	LXT 971-7.5	7.5 (5.5)	15 (11)	5000 / 1000
LXT 970 17.5	LXT 971-17.5	17.5 (12.9)	35 (25.8)	5000 / 1000
LXT 970 75	LXT 971-75	75 (55.3)	150 (110.6)	5000 / 1000
LXT 970 175	LXT 971-175	175 (129)	350 (258)	5000 / 1000
LXT 970 250	LXT 971-250	250 (184.3)	350 (258)	5000 / 1000
LXT 970 500	LXT 971-500	500 (368.6)	750 (552.9)	5000 / 1000

3.0 Technical Characteristics

No.	Model	Series LXT	
	Accuracy Class	1	
		Unit	Value
1	Linearity deviation incl. hysteresis	%ME *	< ± 1.0
2	Rotational Signal Uniformity (RSU)	%ME *	< ± 1.0
3	Repeatability	%ME *	< ± 0.05
	Output signal in general	Unit	Value
4	Frequency range, -3dB point, Bessel characteristics	Hz	1000
5	Analog signal	V	0... 5
6	Signal at torque = Zero	V	≈ 2.5
7	Signal at positive nominal torque	V	> 2.5
8	Signal at negative nominal torque	V	< 2.5
9	Calibration parameter	mV/Nm	---

10	Output resistance	Ω	50							
	Effect of Temperature	Unit	Value							
11	Zero point drift over temperature	%/10K	<1.0							
12	Signal drift over temperature within nominal temperature range ²	%/10K	<1.0							
	Power Supply	Unit	Value							
13	Supply voltage	VDC	9...12							
14	Current Consumption (max.)	mA	10							
15	Start-up peak	mA	<40							
16	Absolute max. supply voltage	VDC	13							
	General Information	Unit	Value							
17	Degree of protection acc. to EN 60529	IP	50							
18	Reference temperature	°C	+15...+35							
19	Operational temperature range	°C	-30...+85							
20	Storage temperature range	°C	-30...+100							
	Nominal rated torque M (bi-directional)	Nm	2.5	5.0	7.5	17.5	75	175	250	500
21	Weight	Rd	g	386	392	400	685	856	1230	
		Sq		395	401	414	652	754	878	
22	Moment of inertia	Rd	g mm ²	597	662	1073	4922	19126	79754	
		Sq		582	648	904	3339	13294	57770	

%ME: related to a full scale measurement range

- 1) The accuracy class implies that taken separately both the linearity deviation as well as the rotational signal uniformity is either lower than or equal to the value of the accuracy class. The accuracy class is not to be identified with the classification following DIN 51309 or EA-10/14.
- 2) The factor of transmission declines linearly up to a maximum of 0.5% / 10K with rising temperature, due to the reduction of the elasticity.

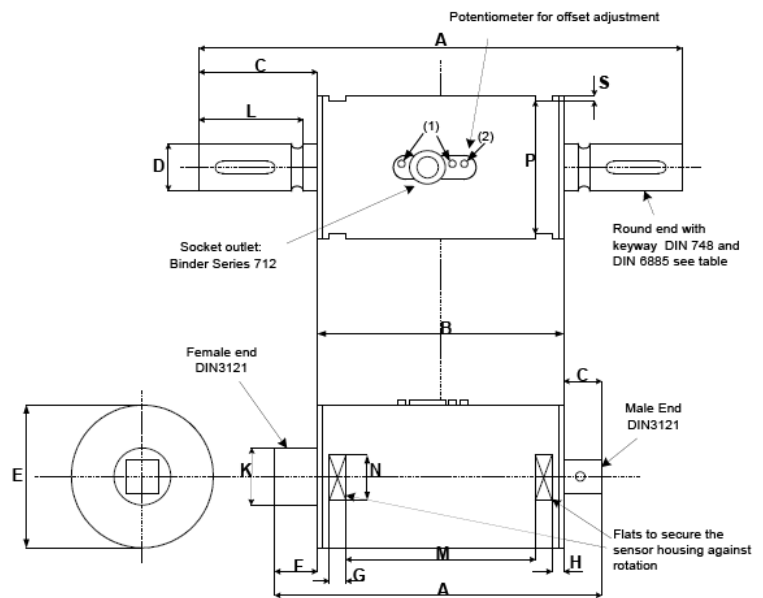
4.0 Dimensions

LXT 971

(Round Drive)

LXT 970

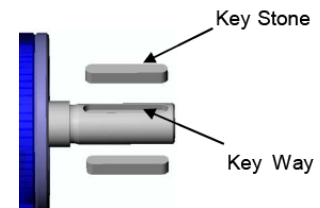
(Square Drive)



(1) Do not loosen or tighten the mounting nuts of the socket and the lock screws.

Dimensions	Nominal Torque Capacity [Nm]	A	B	C	D	E	F	G	H	K	L	M	N	P	S
LXT 970															
¼ inch	2.5 - 5.0 - 7.5 - 17.5	95.5	70	9.5	-	40	16	8	5	12	-	43.9	15	37	1.5
3/8 inch	75	107	70	13	-	50	24	8	5	18	-	43.9	18	47	1.5
½ inch	175-250	123.5	70	18.5	-	50	35	8	5	24	-	43.9	18	47	1.5
¾ inch	500	146	87	29.6	-	60	29.6	10.5	2	33.5	-	61.4	19	57	1.5
LXT 971															
Ø 9 mm	2.5 - 5.0 - 7.5 - 17.5	125	70	27.5	9	40	-	8	5	-	23	43.9	15	37	1.5
Ø 14 mm	75	139	70	34.5	14	50	-	8	5	-	30	43.9	18	47	1.5
Ø 19 mm	175-250	179	70	54.5	19	50	-	8	5	-	50	43.9	18	47	1.5
Ø 25 mm	500	220	87	66.6	25	60	-	10.5	2	-	-	61.4	19	57	1.5

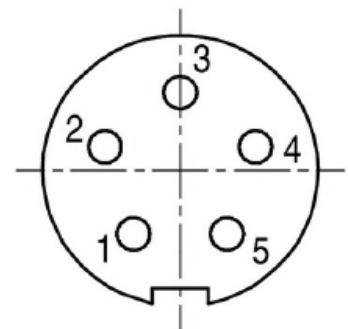
Dimensions Keyway [mm]				Keystones		
Shaft Diameter	Width	Depth	Length	Height	Length	Amount
Ø 9 mm	3	1.8	18.5	3	18	1
Ø 14 mm	5	3	25.5	5	25	1
Ø 19 mm	6	3.5	45.5	6	45	1
Ø 25 mm	8	4	50.5	8	50	2



The second Key Way (only for LXT 971 500) in mirrored position (180°)

5.0 Connection Plan

Pin	Color	Description	Value
1	White	Supply Voltage V_{cc}	9V – 12V
2	Brown	Signal Output analog	
3	Black	Ground GND	
4	Blue	Not Used	
5	Grey	Reference Voltage V_{ref}	2.5v



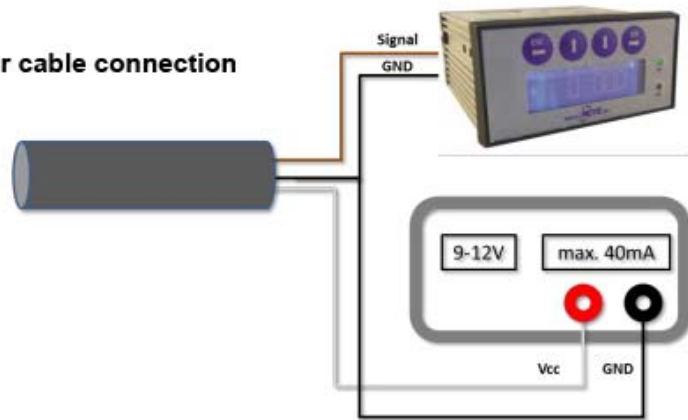
The output V_{ref} is a constant 2.5 V and represents the virtual zero point for direct +/- torque measurement (See below “Sensor cable connection” section B).

At the user side one plug with shielding termination (360°) should be used. If not possible the shielding should accompany the signal as far as it could!

Sensor cable connection

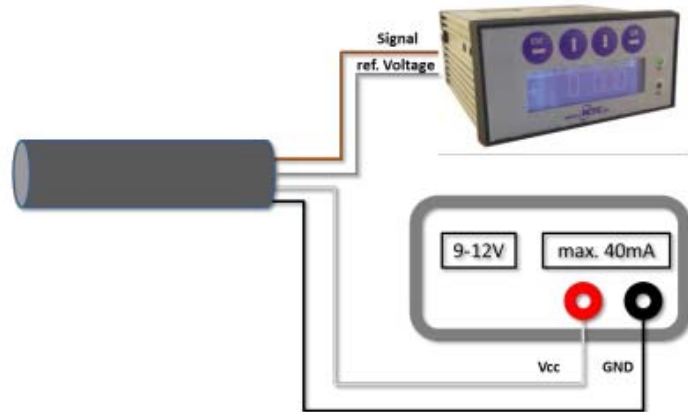
- A) This circuit is recommended for **absolute** torque measurement
e.g. 2.5 V equals to approx. 0 Nm.

Grey and blue wires are not in use.



- B) This circuit is recommended for **relative** torque measurement
C) e. g. 0 V equals to approx. 0 Nm.

Blue wire is not in use.



7. Operating Instructions

7.1 Field of Application The torque sensor is intended for use in an industrial environment (e. g. test bench).

7.2 Scope of Delivery The torque sensor set consists of the sensor itself (signal pick-up and signal processing integrated into sensor housing), one connecting cable with a soldered plug, key stones and the instruction manual.

7.3 Installation and Removal Make sure to install the sensor shafts exactly with the proper aligned connecting shafts. The key stone adapter / square endings of the connecting shafts are to be attached forceless to the corresponding ones of the sensor. No external axial force should be on the housing of the sensor by fixing it. The spanner flat is for the protection of the sensor from distortion. A maximum cable length of 5m must not be exceeded. Using a cable or connector other than supplied with the unit, or a similar cable that is of a different length may affect the overall performance of the sensor. **DO NOT REMOVE THE SHAFT WITH TORQUE APPLIED TO THE SENSOR.**

7.4 Interface Description

Mechanical connection: The key stone adapters on both ends of the measurement shaft are intended for torque transmission.

Electrical connector: On the sensor housing there is a 5-pin socket for the power supply and the signal output (see Chapter 6 Connection Plan).

7.5 Operation (in regular case or in optimal case) Optimal measurement parameters can be achieved when the sensor is applied in accordance to the specification. Use the sensor only for short periods of time at

the maximum rotational speed. By compliance with the specification the sensor works generally trouble-free and maintenance-free.

7.6 Irregular Operation, Measures against Disturbance The presence of external electromagnetic or magnetic fields can lead to irregular measurement results. The mechanical overload on the sensor (e.g. exceeding of maximum allowed torque or severe vibrations) may cause damage to the sensor and in consequence the incorrect signal output. In such cases please do not open the sensor. Contact Cooper Instruments directly for assistance.

7.7 Commissioning After sensor installation pay attention to the following:

- Switch on the power supply unit and check the supply voltage. Peak voltage must be avoided! Be sure to verify the power supply voltage before connecting the sensor!
- Connect the sensor to the power supply unit by using the delivered cable.
- Connect the sensor output to a high-resistance device such as an A/D converter, oscilloscope, PC measurement board. The sensor should be in mechanical unloaded state while connecting it.

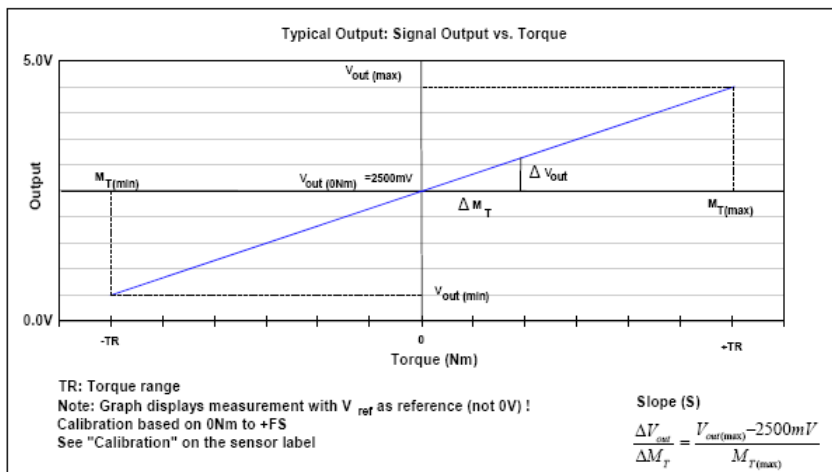
7.8 Service and Maintenance Contact Cooper Instruments at 800-344-3921

7.9 Handling and Transportation In handling, storage and transportation, keep the sensor away from magnetic or electromagnetic fields which may exceed the maximal intensity defined from EMC (see Chapter 3. Technical Characteristics of the Sensor).

7.10 Precautions

- Do not open the sensor housing under any circumstances.
- Do not remove or loosen the locking rings on the shaft ends.
- Do not loosen or tighten the flange-mounting nut of the socket-connector and the fixing screws (1) (see Chapter 5. Dimensions).
- Use only a separate power supply for the sensor.
- Use the sensor only according to the specification (Chapter 3. Technical Characteristics of the Sensor)

8. Typical Sensor Output



$V_{out(max)}$ and $V_{out(min)}$ are defined with the slope of the sensor. i.e. the output voltage could be between 0.5 V and 4.5 V. The actual signal output range depends however on the calibration value.

9.0 Warranty

Limited Warranty On Products

Any Cooper Instruments product which, under normal operating conditions, proves defective in material or in workmanship within one year of the date of shipment by Cooper will be repaired or replaced free of charge provided that a return material authorization is obtained from Cooper and the defective product is sent, transportation charges prepaid, with notice of the defect, and it is established that the product has been properly installed, maintained, and operated within the limits of rated and normal usage. Replacement or repaired product will be shipped F.O.B. from our plant. The terms of this warranty do not extend to any product or part thereof which, under normal usage, has an inherently shorter useful life than one year. The replacement warranty detailed here is the buyer's exclusive remedy, and will satisfy all obligations of Cooper whether based on contract, negligence, or otherwise. Cooper is not responsible for any incidental or consequential loss or damage which might result from a failure of any and all other warranties, express or implied, including implied warranty of merchantability or fitness for particular purpose. Any unauthorized disassembly or attempt to repair voids this warranty.

Obtaining Service Under Warranty

Advance authorization is *required* prior to the return to Cooper Instruments. Before returning the item, contact the Repair Department c/o Cooper Instruments at (540) 349-4746 for a Return Material Authorization number. Shipment to Cooper shall be at buyer's expense and repaired or replacement items will be shipped F.O.B. from our plant in Warrenton, Virginia. Non-verified problems or defects may be subject to a \$100 evaluation charge. Please return the original calibration data with the unit.

Repair Warranty

All repairs of Cooper products are warranted for a period of 90 days from date of shipment. This warranty applies only to those items that were found defective and repaired; it does not apply to products in which no defect was found and returned as is or merely recalibrated. It may be possible for out-of-warranty products to be returned to the exact original specifications or dimensions.

* Technical description of the defect: In order to properly repair a product, it is *absolutely necessary* for Cooper to receive information specifying the reason the product is being returned. Specific test data, written observations on the failure and the specific corrective action you require are needed.