TP-AB/CB Torque Transducers
INSTRUCTION MANUAL

Thank you for purchasing the KYOWA product. Before using it, please read this instruction manual carefully. Also, keep the manual within easy reach so that you can refer to it whenever necessary.

1. Calling the operator's attention

The following cautionary symbols and headlines are used to invite the operator's attention. Be sure to observe the accompanying precautions in order to safeguard the operator and preserve the performance of the instrument.

Warning! Improper handling may cause serious injury to the operator. To avoid harm, be sure to observe the accompanying instructions.

Caution! Improper handling may cause deleterious effects to the operator's body. To avoid harm, be sure to observe the accompanying instructions.

2. Safety precautions

Warning!

- During operation, keep out of the installed equipment, or the operator may be caught in it.
- Avoid torque loads in excess of the allowable overload rating, or the torque transducer may break.

Caution!

- Check that there is no axial eccentricity in the installation and all the devices are placed in their correct positions.
- Provide protective coverings to the devices that are to revolve.
- Check that the screws on the transducer mainframe are tight.

3. Installation precautions

3.1 Using toluene or acetone, remove the rustproof coats from the transducer shaft.

3.2 Where the flexible coupling is not used, centering made on the transducer, motor and load should be within 3/100(mm). When using CB transducer especially, also use the flexible coupling as much as possible. When fixing the mounting legs, take care to avoid force applied in the axial direction.

3.3 Avoid such a manner as causing torque and bending moment simultaneously to the axle of the transducer.
Be sure to connect the motor (the driving device) to the very connector side of the torque transducer.

3.4 Where vibration occurs on the driving device and/or the driven device, provide cushioning axles as illustrated by Fig.3.

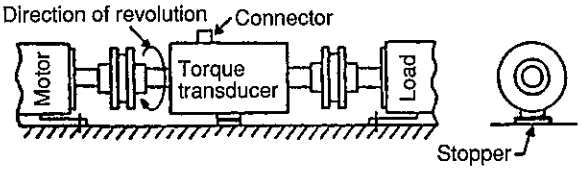


Fig.1 TP-AB

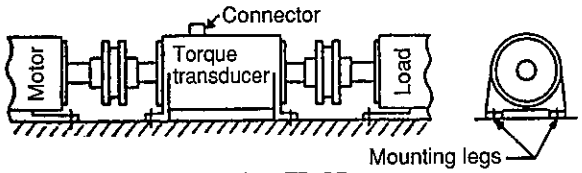


Fig.2 TP-CB

(Example: Where vibration occurs on the driving device)

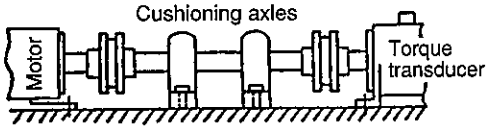
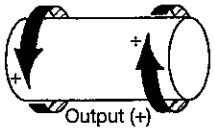


Fig.3 Installing torque transducer

3.5 Sensing direction



3.6 In installing the couplings to the transducer, avoid heating the axle. Also when inserting keys in the axle, carefully handle the tool to avoid impacts on the axle.

3.7 Install the transducer so that the allowable loads described in Table 1 will not be exceeded.

Torque transducer model	Allowable thrust load Approx. (N)	Allowable axle end load Approx.(N)
TP-500GMAB/CB	50	4
TP-1KMAB/CB	100	8
TP-2KMAB/CB	100	15
TP-5KMAB/CB	300	25
TP-10KMAB/CB	500	50
TP-20KMAB/CB	800	60
TP-50KMAB/CB	1000	120
TP-100KMAB/CB	1500	200
TP-200KMAB/CB	1500	400
TP-500KMAB/CB	1500	800
TP-1TMAB/CB	2000	1400
TP-2TMAB/CB	2000	2000

Table 1 Torque transducers' allowable loads

3.8 The transducers adopt neither waterproof nor moistureproof construction. Therefore, do not use the transducer in environments whose relative humidity or temperature is high or in vacuum or corrosive atmospheres.

4. Operation

4.1 Set the external (UP–DOWN) lever to the DOWN position, then perform more than 10 minutes' heat run with no load applied. After that, achieve zero balancing on the measuring instrument connected.

4.2 If torque such as static friction is comparatively large on the load, measuring error may be caused. In this case, revolve the measuring object at a slow speed, find an average of zero drifts, and set the zero point to it. Also, if the cable moves, the zero point too may happen to drift slightly. Therefore fix the cable so that it will be kept from moving largely.
Also, if the motor is started suddenly when with a load applied, overloading may be caused, thus resulting in breaking of the transducer axle. Take greatest care to avoid harm. (If abnormal sound is heard, check the state of installation once again.)

4.3 For measurement of dynamic torque such as motor torque fluctuation and starting characteristic, the relation between the moment of inertia on the motor/load and the torque transducer's natural frequency will raise problems. What deserves attention here is that the torque transducer's natural frequency must be sufficiently high against the frequency of torque fluctuation.
For information about the torque transducer's natural frequency, contact KYOWA. Table 2 below shows the torsional angle, spiral spring coefficient and moment of inertia against the rated torque.

Torque transducer model	Angle of torsion (rated) Approx.(rad)	Spiral spring's constant (N·m/rad) Approx.	Moment of inertia ($kg \cdot cm^2$) Approx.
TP-500GMAB/CB	0.038	131	0.52
TP-1KMAB/CB	0.032	313	0.52
TP-2KMAB/CB	0.029	690	0.52
TP-5KMAB/CB	0.021	2381	2.7
TP-10KMAB/CB	0.021	4762	2.7
TP-20KMAB/CB	0.015	13333	18
TP-50KMAB/CB	0.016	31250	18
TP-100KMAB/CB	0.012	83333	150
TP-200KMAB/CB	0.012	166667	160
TP-500KMAB/CB	0.014	357143	210
TP-1TMAB/CB	0.014	714286	1,200
TP-2TMAB/CB	0.017	1176471	2,000

Table 2. Torque transducers' characteristic values

5. Maintenance and inspection

5.1 Many hours' operation causes wear of the brush. Powders then come to stick to the insulated internal parts, thereby causing a progressive decrease in the insulation resistance. To avoid harm, periodically remove the cover (from the side to which the name plate is attached) and brush powders off the surfaces of internal parts. After that, apply compressed air to remove powders completely. (In the case of TP-10KMCB for instance, this cleaning should be made after every 50 to 60 hours of running at a speed of 3000 rpm.)

5.2 Oil that adhered to the slip ring surface or to the brush will cause unstable readings on the measuring instrument. Remove oil with cloth damped with acetone or methylene chloride.

5.3 If the brush is found polluted by oil, request KYOWA for a replacement.

5.4 Wear of the brush is in proportion to the circumferential speed (rotating speed) the transducer has run. Calculate the total operating hours, then confirm the degree of brush wear in Fig.4 below.

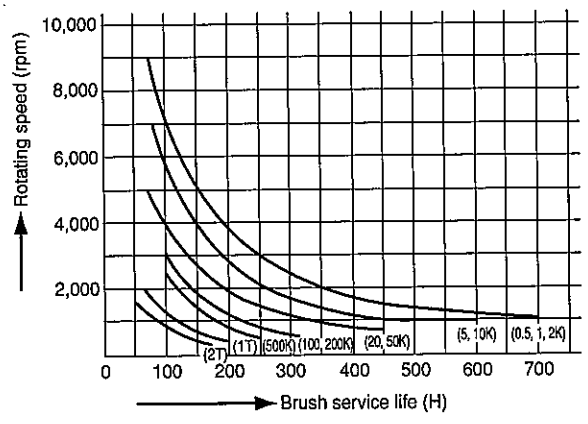


Fig.4 Brush wear in course of time

5.5 Where the torque transducer was not used for a long time, lightly polish the slip ring surface with water-resisting sandpaper (#1200). After polishing, softly wipe the slip ring surface with a piece of cloth or gauze, and after that, clean the surface with a clean piece of gauze damped with acetone, etc.

6. Wiring

6.1 Wiring diagram

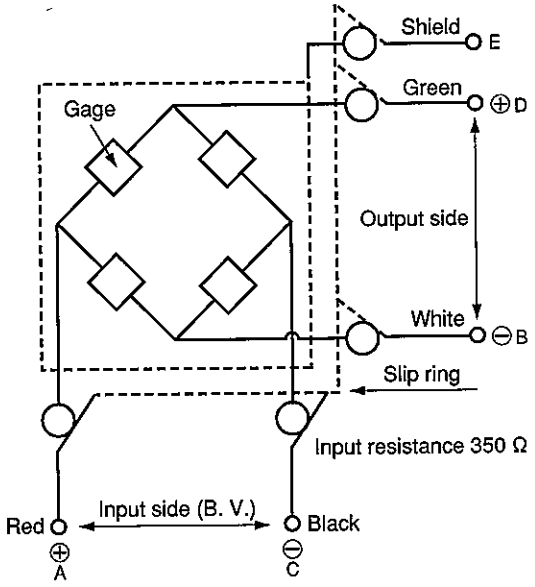


Fig.5

6.2 Connector pin numbers and discrimination colors

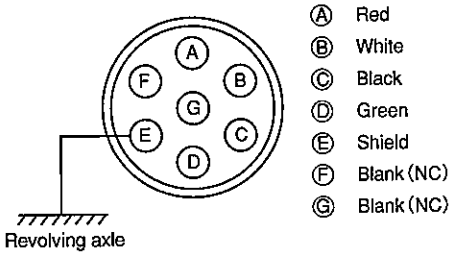


Fig.6

7. How to calculate torque

7.1 To convert output voltages into torque values, use the calibration factor described in the inspection sheet.

7.2 When using a strain amplifier, outputs will read in $\varepsilon \times 10^{-6}$ equivalent strain. The torque value corresponding to 1×10^{-6} equivalent strain is stated in the inspection sheet. The torque value is then found through multiplication.

$$\text{Torque} = (\text{Strain amplifier output } \varepsilon \times 10^{-6}) \times (\text{Calibration factor N·m/1} \times 10^{-6})$$

7.3 If an amplifier other than KYOWA is used, it is necessary to know accurately the bridge excitation voltage applied by the input side in Fig.5. Then calculate to what μV/V this output voltage corresponds. The inspection sheet also states the torque value which corresponds to 1μV/V. The torque value is then calculated through multiplication.

$$\text{Torque} = \frac{\text{Bridge output voltage } \mu V}{\text{Bridge excitation voltage V}} \times (\text{Calibration factor N.m/1/1}\mu V/V)$$

7.4 Where the cable (10m long as standard) is extended, correct the reading, using the following equation. (See Fig.7.)

$$e2 = \frac{e1}{1 + a \cdot L}$$

where e2: Output voltage sensitivity (μV/V) of cable after extension

e1: Output voltage sensitivity (μV/V) of cable of standard length, 10(m)

(This value is stated in the inspection sheet.)

a: Calibration factor

(1) With 0.3(mm^2) x 4-conductor shielded chloroprene cabtire cable

$a = 3.789 \times 10^{-4}$

(2) With 0.5(mm^2) x 4-conductor shielded chloroprene cabtire cable

$a = 2.274 \times 10^{-4}$

L: Length of extended cable (m)

(Length after deduction of 10(m) standard length)

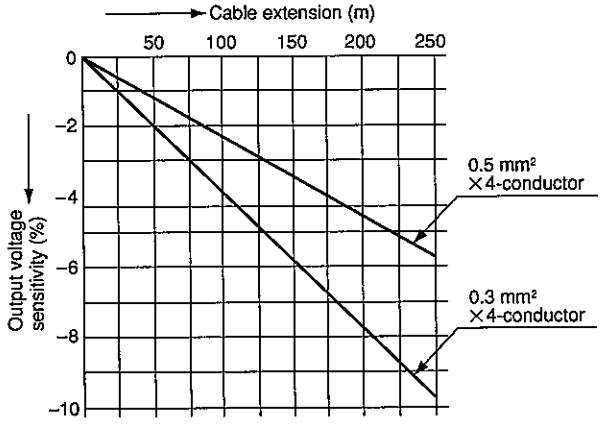


Fig.7 Output sensitivity change due to cable extension

8. Storage and maintenance precautions

8.1 Take care to avoid water, oil and dust on the connector plug.

8.2 If zero balancing or readings are found abnormal, check the bridge resistance by referring to Fig.5 and 6. If a discrepancy of several Ω is found between the bridge resistance measured and that described in the inspection sheet, the cause may be failure of

8.3 the transducer.
Suppose that the bridge resistance is found normal, check the insulation resistance next by applying an excitation voltage not exceeding 50V. If the resistance is found lower than 100MΩ, the cause may be failure of the transducer.

For more information you may need, contact your KYOWA representative or KYOWA.

9. Specifications

Model	Rated capacity	Max. rotating speed
TP-500GMAB/CB	5N·m (509.9gf·m)	9000rpm
TP-1KMAB/CB	10N·m (1.020kgf·m)	9000rpm
TP-2KMAB/CB	20N·m (2.039kgf·m)	9000rpm
TP-5KMAB/CB	50N·m (5.099kgf·m)	7000rpm
TP-10KMAB/CB	100N·m (10.20kgf·m)	7000rpm
TP-20KMAB/CB	200N·m (20.39kgf·m)	5000rpm
TP-50KMAB/CB	500N·m (50.99kgf·m)	5000rpm
TP-100KMAB/CB	1kN·m (102.0kgf·m)	3000rpm
TP-200KMAB/CB	2kN·m (203.9kgf·m)	3000rpm
TP-500KMAB/CB	5kN·m (509.9kgf·m)	2500rpm
TP-1TMAB/CB	10kN·m (1.020tf·m)	2000rpm
TP-2TMAB/CB	20kN·m (2.039tf·m)	1500rpm

NOTE: The unit and numerical values in brackets in the [CAP.] column on the nameplate and in the above rated capacity column depend on the conventional unit expression just for reference.

Rated output: 1.5mV/V(3000 x 10^{-6} strain) ±0.2% (on TP-500GM to 200KMAB/CB)
1.5mV/V(3000 x 10^{-6} strain) ±0.5% (on TP-500KM to 2TMAB/CB)

Non-linearity: ±0.2%RO

Hysteresis: ±0.2%RO

Recommended excitation voltage: 1 to 6V, AC or DC

Safe overload rating: 120%

Bridge resistance: 350Ω±0.5%

Thermal effect on zero balance: ±0.01%RO/°C (rated capacity: 5N·m to 2kN·m)
±0.05%RO/°C (rated capacity: 5 to 20kN·m)

Thermal effect on output: ±0.03%/°C (rated capacity: 5N·m to 2kN·m)
±0.05%/°C (rated capacity: 5 to 20kN·m)

Temperature compensated range: 0 to 60°C

Safe temperature range: 0 to 60°C

Revolution-induced noise: 12 x 10^{-6} $strain_{p-p}$ or below

Cable: 0.3mm^2, 4-conductor shielded chloroprene 10m, ø7.6mm, terminated in connector plug on both ends

■Accessories:

Calibration sheet	1
Instruction manual	1
Cable	1
Keys	1 set

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