



# TPS-A Torque Transducer INSTRUCTION MANUAL

Thank you for purchasing TPS-A Torque Transducer (hereinafter referred to as the TPS-A). 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.

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

 <b>Warning!</b>	Improper handling may cause serious injury to the operator. To avoid harm, be sure to observe the accompanying instructions.
 <b>Caution!</b>	Improper handling may cause deleterious effects to the operator's body. To avoid harm, be sure to observe the accompanying instructions.

## 1. Handling

### 1.1 Preparation of shaft

The shaft is coated with preservative. Remove the preservative from the TPS-A shaft by using organic solvent, etc. before using the TPS-A. There may be a scratch on the shaft. However, it has no effect on the specifications.

### 1.2 Installing TPS-A

Use a friction-joint coupling to joint the TPS-A shaft.

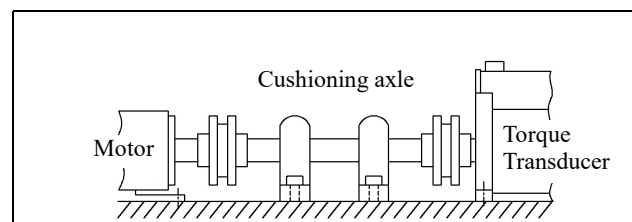
In addition, when the TPS-A is installed on a flat surface, due to tolerance of using parts, slight space (0.2 mm or less) may exists between the two surfaces and has no problem. Fix the TPS-A by referring 1.3.

#### **Warning!**

- Provide protective coverings to the devices that are to revolve. During operation, keep out of the installed equipment, or the operator may be caught in it.
- Avoid such a manner as causing torque and bending moment simultaneously to the axle of the TPS-A.

#### **Caution!**

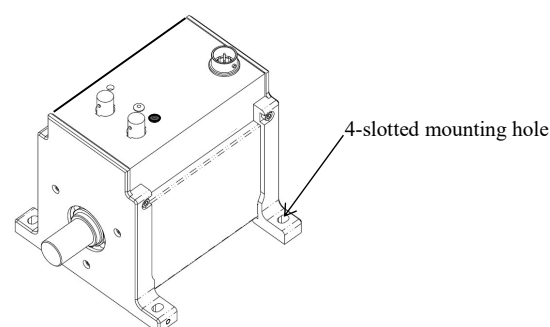
- It is recommended to use the KYOWA specified coupling (see "5. Specifications"). When you do not use the KYOWA specified coupling, be sure to use a flexible coupling.
- The coupling should mount within the max. permissible misalignment.
- The TPS-A construction resists against neither water nor moisture. Therefore, do not use it in abnormally high humidity environments or in vacuum or corrosive atmosphere.
- Where vibration occurs on the driving device and/or the driven device, provide cushioning axle.



### 1.3 Fixing TPS-A

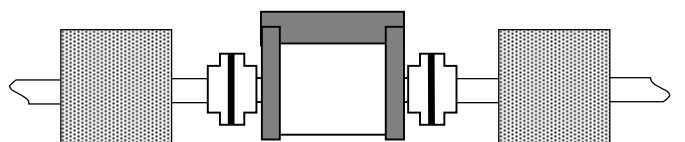
Insert the hexagon socket head bolt (M4) and plain washer (nominal diameter: 4) into every slotted mounting hole and fix them. (The hexagon socket head bolts and plain washers are not included.)

The purpose of the fixing is to prevent the TPS-A from rotation. When fixing the TPS-A, make sure the TPS-A axis matches the other axes properly.

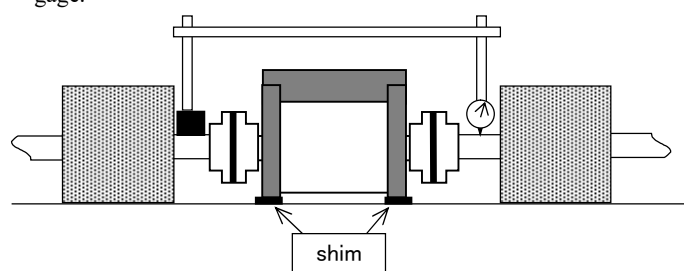


### Example

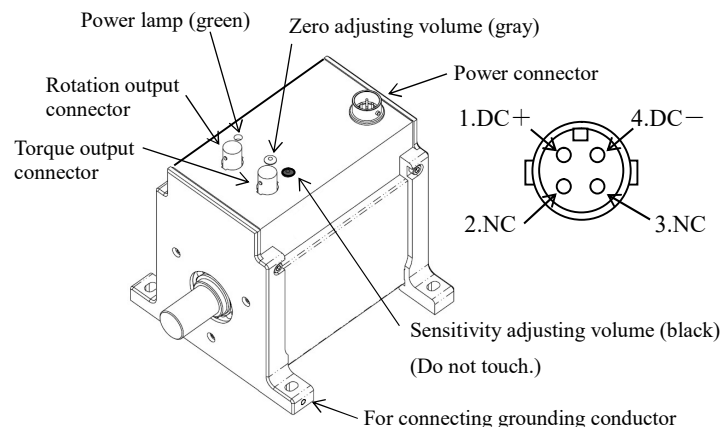
- ① Connect the TPS-A axis and other axes by using a flexible coupling.



- ② Match the TPS-A axis height and flexible coupling height by using a shim and fix them. Measure the concentricity of axes by using a dial gage.



## 2. Connecting



### 2.1 Power

It is necessary to supply 10 VDC to 16 VDC to the power connector. (12 VDC is recommended.) The negative (-) side of the DC power is insulated from TPS-A case and screw hole for grounding.

#### For using AC adapter

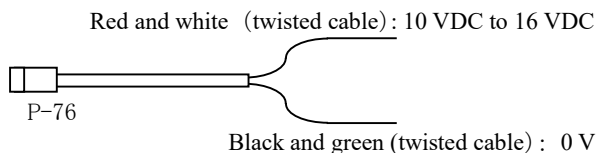
It is recommended to use the KYOWA specified AC adapter “SA-10A-EDS” (option, see “5. Specifications”).

Connect the AC adapter to the power connector. The power lamp lights up.

#### For using DC power

It is recommended to use the KYOWA specified power cable “P-76” (option, see “5. Specifications”).

After connecting the power cable to the power connector, supply 10 VDC to 16 VDC from the external DC power. The power lamp lights up.



## ! Caution!

- Use 10 VDC to 16 VDC power. In addition, use power with less noise. Or, electronic components may be damaged.
- Be sure to ground the TPS-A by using screw holes for grounding.
- Be sure to connect power correctly.
- Fix cables to keep them from moving due to vibration.

### 2.2 Torque output

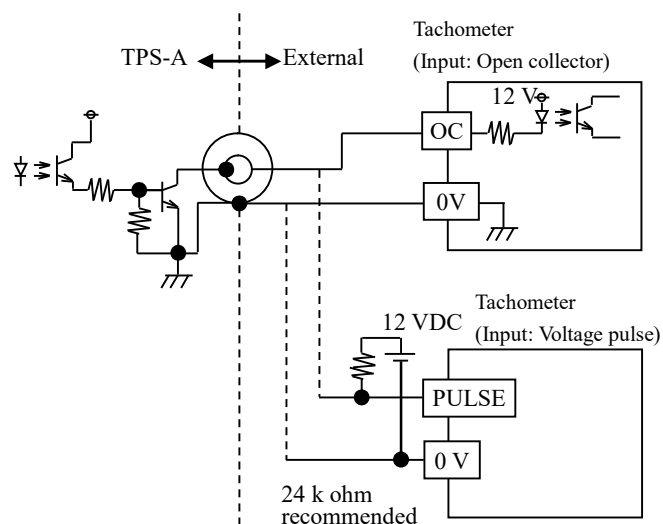
The TPS-A outputs voltage proportional to the torque from the “VOLTAGE OUTPUT” connector. Connect the TPS-A to a device that can measure voltage by using a cable with BNC connector (option, see “5. Specifications”).

## ! Caution!

- Use coaxial cable or shielded cable for connecting the external device. Longer cables are susceptible to noise. (within 3 m recommended)
- Do not short-circuit the “VOLTAGE OUTPUT” terminals. Or, it may cause trouble.
- Do not apply voltage to the torque output connector from external. Or, it may cause trouble.
- Fix cables to keep them from moving due to vibration.
- The - side of the torque output connector has same potential with the TPS-A.

### 2.3 Rotation output

The TPS-A outputs four pulses/rotation based on open collector method from the “PULSE OUTPUT” connector. Connect the TPS-A to the tachometer (it is recommended to use “460C(TSURUGA ELECTRIC CORPORATION)” or equivalent), etc. by using the cable with BNC connector.



#### Open collector output

Contact capacity	30 VDC, 30 mA or less
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#### Recommended specifications of the target tachometer

Open collector input	
Contact capacity	30 VDC, 30 mA or less
Input frequency	0.1 Hz to 400 Hz or more
Minimum pulse width	15 $\mu$ s or more

Voltage pulse input	
Lo level	$\pm 0$ V to 2.0 V
Hi level	4.5V to 30V
Input frequency	0.1 Hz to 400 Hz or more
Minimum pulse width	15 $\mu$ s or more

### Caution!

- Use coaxial cable or shielded cable for connecting the external device. Longer cables are susceptible to noise. (within 3 m recommended)
- Do not short-circuit the “VOLTAGE OUTPUT” terminals. Or, it may cause trouble.
- Do not apply voltage to the torque output connector from external. Or, it may cause trouble.
- The TPS-A outputs middle-level pulse when the TPS-A stops.
- Fix cables to keep them from moving due to vibration.

## 3. Measuring

### 3.1 Adjusting zero

For adjusting the zero point of the torque output after mounting the TPS-A, use the zero adjusting volume on the upper side.

Remove a gray cap and turn around the zero adjusting volume with precision screwdriver, etc.

Adjusting range is approx.  $\pm 100\text{mV}$ .

### Caution!

- Replace the cap to prevent the volume from dust or oil after adjusting the zero.
- If you use the TPS-A at vibration place for a long term, the zero adjusting volume increases little by little and the zero point may move. Check the zero point at regular intervals. To fix the zero adjusting volume temporarily, paste commercially available lacquer composition, etc. little.
- The torque output of the TPS-A is adjusted to 0 V with no rotation and no load applied. Check the flatness of the mounted surface and center alignment so as not to apply excessive force to the TPS-A when output with no-load applied exceeds the zero adjustment range.
- Do not touch the sensitivity adjusting volume by removing a black cap. Or, values on the Test Data Sheet and Specifications are not guaranteed.

### 3.2 Test run

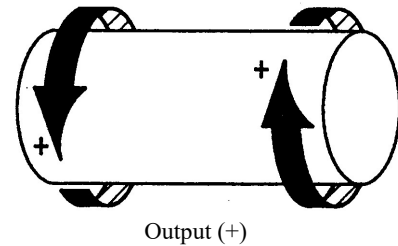
If you can rotate the axis, rotate the axis 2 or 3 times by hand first and check that the axis rotates correctly. Then test run the TPS-A at low speed and check that the axis rotates smoothly.

### Warning!

The TPS-A may output voltage exceeding the rated output in case of the failure. Be sure to arrange a protection circuit when measuring data. In addition, check that the TPS-A is not emitting abnormal noise with rotation.

### 3.3 Measuring

The TPS-A outputs voltage to + side when load is applied to the TPS-A axis as follows. When load is applied to the reverse direction, the TPS-A outputs voltage to – side.



### Warning

- Operate the TPS-A with the rated output or less. Or, the TPS-A may be damaged or wrecked.
- Pay attention to torsional natural frequency of TPS-A, the driving device and the driven device. Do not rotate the TPS-A at the rotation speed that is close to natural frequency. Or, the TPS-A may be damaged due to resonance.
- Do not apply external impact forces (including the load applied to torques and axes, due to the sudden acceleration and sudden braking). Or, the TPS-A may be destroyed or damaged.

### 3.4 Conversion

The measured voltage is calculated to torque with calibration coefficient.

The calibration coefficient is described in the Test Data Sheet.

$$\text{Torque [N}\cdot\text{m]} = (\text{Measured value [V]}) \times (\text{Calibration Coefficient [N}\cdot\text{m/V]})$$

### 3.5 Countermeasures against noise

Apart the torque output cable from the wiring of the power system since the – side of the torque output and casing of the TPS-A are short-circuited.

To avoid induction noise, keep the TPS-A away from instruments having large leakage flux (such as big motor, transformer, etc).

Electrical potential may generate when noise entered to the TPS-A and mount. At this time, try to connect the TPS-A and grounding wire of measuring instrument.

## 4. Storage and maintenance precautions

- Protect the TPS-A from condensation due to abrupt temperature change.
- Take care to avoid water, oil and dust on the connection plug.
- The bearing inside the TPS-A is a consumable item. When you continuously operate the TPS-A at the maximum rotation speed, replace it every year (5NM can not replace the bearing).
- If readings are found abnormal, measure power voltage and consumption current. If an abnormal measured value appears or abnormal behavior (abnormal sound, abnormal vibration, etc.) occurs, contact KYOWA or our representatives.
- Do not disassemble the TPS-A.

## 5. Specifications

Model	Rated capacity	Safe overload rating (*)	Moment of inertia
TPS-A-5NM	5 N·m	150%	$2.5 \times 10^{-4} \text{ kg} \cdot \text{m}^2$
TPS-A-10NM	10 N·m	150%	$2.6 \times 10^{-4} \text{ kg} \cdot \text{m}^2$
TPS-A-50NM	50 N·m	120%	$2.6 \times 10^{-4} \text{ kg} \cdot \text{m}^2$
TPS-A-100NM	100 N·m	150%	$2.7 \times 10^{-4} \text{ kg} \cdot \text{m}^2$

(\*) Output is saturated at approx. 110% the rated capacity.

Model	Temperature effect on output	Safe bending moment (*)	Safe load at shaft end	Weight (Approx.)
TPS-A-5NM	Within $\pm 0.1\%/^{\circ}\text{C}$	1.5 N·m	300 N	1.5 kg
TPS-A-10NM	Within $\pm 0.05\%/^{\circ}\text{C}$	3 N·m	300 N	1.8 kg
TPS-A-50NM	Within $\pm 0.05\%/^{\circ}\text{C}$	15 N·m	300 N	1.8 kg
TPS-A-100NM	Within $\pm 0.05\%/^{\circ}\text{C}$	15 N·m	600 N	1.8 kg

(\*) For a single sensor

Dimensions	(Refer to the end.)
Rated output	$5\text{V} \pm 4\%$
Nonlinearity	Within $\pm 0.3\%R_0$
Hysteresis	Within $\pm 0.3\%R_0$
Compensated temperature range	$-10$ to $60^{\circ}\text{C}$ (noncondensing)
Safe temperature range	$-10$ to $70^{\circ}\text{C}$ (noncondensing)
Temperature effect on zero balance	Within $\pm 0.03\%R_0/^{\circ}\text{C}$
Maximum rotation speed	5000 rpm
Rotation speed output	4 pulse/rotation (open collector)
Cutoff frequency	200 Hz
Amplitude ratio	$-3 \pm 2\text{dB}$ (at cutoff point)
Load resistance	5 kohm or more
SN ratio	45 dB or more (at no rotation)
Power supply	10 VDC to 16 VDC
Current consumption	Approx. 0.5 A (with 12 VDC supplied)
Protection rating	IP40

[Reference value]

Torsion spring constant and angle of torsion

Model	Torsion spring constant (Approx.)	Angle of torsion by the rated (Approx.)
TPS-A-5NM	$6.15 \times 10^2 \text{ N} \cdot \text{m} / \text{rad}$	$8.1 \times 10^{-3} \text{ rad}$
TPS-A-10NM	$1.15 \times 10^3 \text{ N} \cdot \text{m} / \text{rad}$	$8.7 \times 10^{-3} \text{ rad}$
TPS-A-50NM	$6.57 \times 10^3 \text{ N} \cdot \text{m} / \text{rad}$	$7.6 \times 10^{-3} \text{ rad}$
TPS-A-100NM	$1.09 \times 10^4 \text{ N} \cdot \text{m} / \text{rad}$	$9.2 \times 10^{-3} \text{ rad}$

Accessories	Test Data Sheet	1
	Warranty	1
	Instruction Manual	1

