

## OPERATING MANUAL

### Torque Motors

#### Introduction

##### ■ Before using the motor

Only qualified personnel of electrical and mechanical engineering should work with the product.



Use the product correctly after thoroughly reading the section “Safety precautions.” In addition, be sure to observe the contents described in warning, caution, and note in this manual.

The product described in this manual has been designed and manufactured to be incorporated in general industrial equipment. Do not use for any other purpose. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

If you have purchased a **TMP-1**, also refer to the operating manual for **TMP-1**.

#### Safety precautions

The precautions described below are intended to prevent danger or injury to the user and other personnel through safe, correct use of the product. Use the product only after carefully reading and fully understanding these instructions.

 <b>WARNING</b>	Handling the product without observing the instructions that accompany a “WARNING” symbol may result in serious injury or death.
 <b>CAUTION</b>	Handling the product without observing the instructions that accompany a “CAUTION” symbol may result in injury or property damage.
<b>Note</b>	The items under this heading contain important handling instructions that the user should observe to ensure safe use of the product.

#### **WARNING**

- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. Doing so may result in fire, electric shock or injury.
- Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so may result in fire, electric shock or injury.
- Do not transport, install the product, perform connections or inspections when the power is on. Always turn the power off before carrying out these operations. Failure to do so may result in electric shock.
- Turn off the power in the event the overheat protection device (thermal protector) is triggered. Failure to do so may result in injury or damage to equipment, since the motor will start abruptly when the overheat protection device (thermal protector) is automatically reset.
- The motor is Class I equipment. When installing the motor, be sure to ground it. Failure to do so may result in electric shock.
- Install the motor in an enclosure in order to prevent electric shock or injury.
- Keep the input-power voltage within the specification to avoid fire and electric shock.
- Connect the cables securely according to the wiring diagram in order to prevent fire and electric shock.
- Do not forcibly bend, pull or pinch the lead wires. Doing so may result in fire and electric shock.
- Be sure to insulate the connection terminal of the capacitor. Failure to do so may result in electric shock.
- Turn off the power in the event of a power failure, or the motor will suddenly start when the power is restored and may cause injury or damage to equipment.
- Do not touch the connection terminal of the capacitor immediately after the power is turned off (for a period of 30 seconds). The residual voltage may cause electric shock.
- Do not disassemble or modify the motor. This may cause electric shock or injury.

Thank you for purchasing an Oriental Motor product.

This Operating Manual describes product handling procedures and safety precautions.

- Please read it thoroughly to ensure safe operation.
- Always keep the manual where it is readily available.

#### **CAUTION**

- Do not use the motor beyond its specifications, or electric shock, injury or damage to equipment may result.
- Do not touch the motor during operation or immediately after stopping. The surface is hot and may cause a skin burn(s).
- Do not hold the motor output shaft or motor lead wires. This may cause injury.
- Keep the area around the motor free of combustible materials in order to prevent fire or a skin burn(s).
- To prevent the risk of damage to equipment, leave nothing around the motor that would obstruct ventilation.
- To prevent bodily injury, do not touch the rotating parts (output shaft) of the motor during operation.
- Immediately when trouble has occurred, stop running and turn off the power. Failure to do so may result in fire, electric shock or injury.
- The motor surface temperature may exceed 70 °C (158 °F) even under normal operating conditions. If the operator is allowed to approach a running motor, attach a warning label as shown in the figure in a conspicuous position. Failure to do so may result in skin burn(s).



Warning label

## Preparation

### ■ Checking the product

Verify that the items listed below are included. Report any missing or damaged items to the branch or sales office from which you purchased the product.

#### ● Motor

- Motor .....1 unit
- Capacitor .....1 piece
- Capacitor cap.....1 piece
- Instructions and Precautions for Safe Use.....1 copy

#### ● Gearhead (sold separately)

- Gearhead.....1 unit
- Mounting screw set .....1 set  
(Mounting screws, hexagonal nuts, washers 4 pieces. each, parallel key 1 piece \*)

\* The mounting screw set is not supplied with motors having no key grooves on the output shaft.

### ■ Combination tables

Check the model number against the number indicated on the product.

#### ● Pinion shaft type

Model	Motor model	Capacitor model	Applicable gearhead model*
2TK3GN-AW2J	2TK3GN-AW2	CH70CFAUL2	2GN□K 2GN□S
2TK3GN-AW2U		CH60CFAUL2	
2TK3GN-CW2J	2TK3GN-CW2	CH18BFAUL	2GN□K 2GN□S
2TK3GN-CW2E		CH15BFAUL	
3TK6GN-AW2J	3TK6GN-AW2	CH110CFAUL2	3GN□K 3GN□S
3TK6GN-AW2U		CH90CFAUL2	
3TK6GN-CW2J	3TK6GN-CW2	CH30BFAUL	3GN□K 3GN□S
3TK6GN-CW2E		CH25BFAUL	
4TK10GN-AW2J	4TK10GN-AW2	CH140CFAUL2	4GN□K 4GN□S
4TK10GN-AW2U		CH110CFAUL2	
4TK10GN-CW2J	4TK10GN-CW2	CH35BFAUL	4GN□K 4GN□S
4TK10GN-CW2E		CH30BFAUL	
5TK20GN-AW2J	5TK20GN-AW2	CH180CFAUL2	5GN□K 5GN□S
5TK20GN-AW2U		CH140CFAUL2	
5TK20GN-CW2J	5TK20GN-CW2	CH45BFAUL	5GN□K 5GN□S
5TK20GN-CW2E		CH40BFAUL	

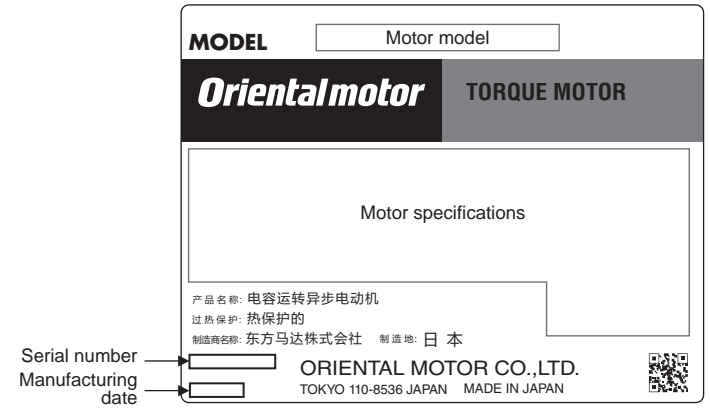
\* □ in the gearhead model name represents a number indicating to the gear ratio.

#### ● Round shaft type

Model	Motor model	Capacitor model
2TK3A-AW2J	2TK3A-AW2	CH70CFAUL2
2TK3A-AW2U		CH60CFAUL2
2TK3A-CW2J	2TK3A-CW2	CH18BFAUL
2TK3A-CW2E		CH15BFAUL
3TK6A-AW2J	3TK6A-AW2	CH110CFAUL2
3TK6A-AW2U		CH90CFAUL2
3TK6A-CW2J	3TK6A-CW2	CH30BFAUL
3TK6A-CW2E		CH25BFAUL
4TK10A-AW2J	4TK10A-AW2	CH140CFAUL2
4TK10A-AW2U		CH110CFAUL2
4TK10A-CW2J	4TK10A-CW2	CH35BFAUL
4TK10A-CW2E		CH30BFAUL
5TK20A-AW2J	5TK20A-AW2	CH180CFAUL2
5TK20A-AW2U		CH140CFAUL2
5TK20A-CW2J	5TK20A-CW2	CH45BFAUL
5TK20A-CW2E		CH40BFAUL

### ■ Information about nameplate

The figure shows an example.



The position describing the information may vary depending on the product.

## Installation

### Location for installation

The motor is designed and manufactured for installation in equipment. Install it in a well-ventilated location that provides easy access for inspection. The location must also satisfy the following conditions:

- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature
  - 10 to +40 °C (+14 to +104 °F) (non-freezing)
  - 10 to +50 °C (+14 to +122 °F) for 100/200 V
- Operating ambient humidity 85% or less (non-condensing)
- Area that is free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- Area not exposed to direct sun
- Area free of excessive amount of dust, iron particles or the like
- Area not subject to splashing water (rain, water droplets), oil (oil droplets) or other liquids
- Area free of excessive salt
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- 1000 m or less above sea level

**Note** On rare occasions, grease may ooze out from the gearhead. If there is a concern over possible environmental damage resulting from the leakage of grease, provide an oil tray or similar oil catching mechanism in order not to cause a secondary damage. Grease leakage may lead to problems in the customer's equipment or products.

### How to install the motor

#### Pinion shaft type

##### 1. Assembling the motor and gearhead

Check the model names for the motor and gearhead.

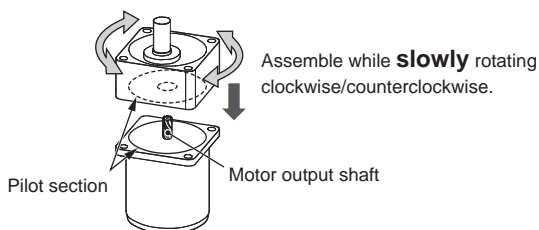
Only a motor and a gearhead having the same frame size and the same type of pinion can be combined.



Assemble the gearhead to the motor in a condition where the motor output shaft is set upward. Wipe off the grease if it is adhered to the pilot section of the gearhead.

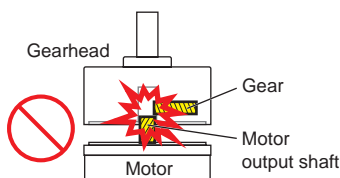
Keep the pilot sections of the motor and gearhead in parallel, and assemble while slowly rotating the gearhead clockwise/counterclockwise. Also, assemble so that no gap remains between the motor and gearhead.

When using a decimal gearhead, install it between the motor and the gearhead.



#### Precaution when assembling

Do not forcibly assemble a motor and a gearhead, or do not hit the motor output shaft with the gearhead or the gear. Also, prevent metal objects or foreign substances from entering in the gearhead. The motor output shaft or the gear may be damaged, resulting in noise or shorter service life.

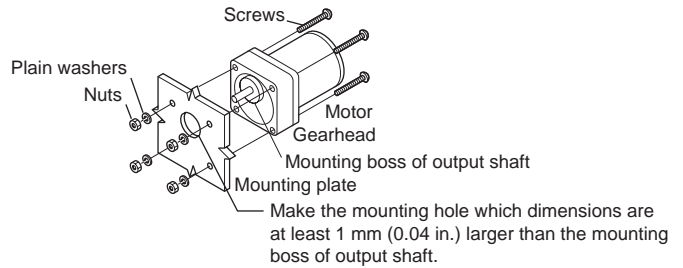


#### 2. Installing to equipment

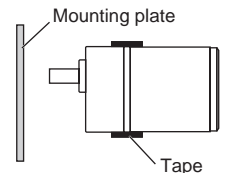
Use the mounting screw set included with a gearhead to secure the motor and gearhead to the mounting plate.

Install so that there is no gap between the product and the mounting plate.

If a decimal gearhead is used, secure all parts using the screws included with the decimal gearhead.



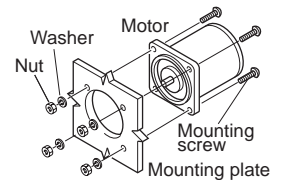
If the motor and gearhead are about to come off when installing to equipment, temporarily fix the motor and gearhead with tape.



#### Round shaft type

Drill holes on the mounting plate and fix the motor on the plate using screws, nuts, and washers (not supplied).

Be careful there is no gap between the motor installation surface and the bracket.



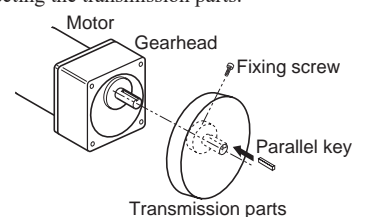
Model	Nominal diameter of screw	Tightening torque [N·m (lb-in)]
<b>2TK</b>	M4	2.0 (17.7)
<b>3TK</b>	M5	2.5 (22)
<b>4TK</b>	M5	2.5 (22)
<b>5TK</b>	M6	3.0 (26)

**Note** Do not insert the motor into the mounting hole at an angle or force it in, as this may scratch the flange pilot section and damage the motor.

#### Attaching load

To shaft of the gearhead has been machined to an outer diameter tolerance of h7 and is provided with a key slot for connecting the transmission parts.

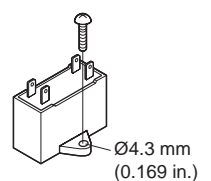
(The **2GN** type has a surface cut by milling.) When connecting the transmission parts, ensure that the shaft and parts have a clearance fit, and always fix the parallel key to the output shaft with a screw to prevent the parts from rattling or spinning.



**Note** Do not use excessive force, or hammer the transmission parts onto the gearhead shaft as damage may occur.

#### Mounting the capacitor

Before mounting the supplied capacitor, check that the capacitor's capacitance matches that stated on the motor's name plate. Mount the capacitor securely by using M4 screws (not provided).



**Note**

- Do not let the screw fastening torque exceed 1 N·m (8.8 lb-in) to prevent damage to the mounting foot.
- Mount capacitor at least 10 cm (3.94 in.) away from the motor. If it is located closer, the life of the capacitor will be shortened.

## Connection and operation

Insulate all the wire connections, such as the connection between the motor and the capacitor connection.

Ground the motor using a Protective Earth Terminal.

For details on connecting the motor and power controller, refer to the operating manual for **TMP-1**.

- Note**
- Insulation class of this motor is B. Make sure that the motor case temperature does not exceed 90 °C (194 °F) during operation of the motor. Operation exceeding case temperature 90 °C (194 °F) may significantly deteriorate the coils and ball bearings of the motor and shorten the motor's life span. Motor case temperature can be measured by fixing a thermometer on the motor surface. It can also be measured using thermo tape or a thermocouple.
  - To change rotation direction wait until the motor completely stops. Otherwise its direction may not change or may take much time to change.
  - If the motor is to be used with AC voltage, connect the supplied capacitor. Keep the capacitor connected even after the motor has been started.

### Rotating direction of the gearhead output shaft

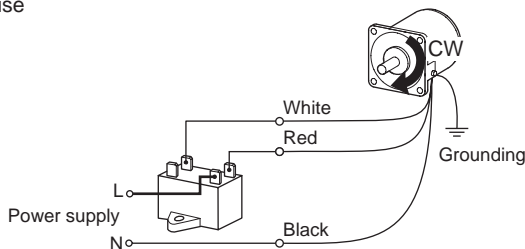
The rotating direction of the gearhead output shaft may be opposite that of the motor shaft, depending on the gear ratio. Before performing wiring, be sure to check the rotating direction of the gearhead output shaft to be used and determine the desired direction of motor rotation.

Gearhead model	Gear ratio	
	Same as the rotating direction of motor shaft	Opposite the rotating direction of motor shaft
<b>2GN, 3GN, 4GN, 5GN</b>	<b>3 to 18</b>	<b>25 to 36</b>
	<b>50 to 180</b>	

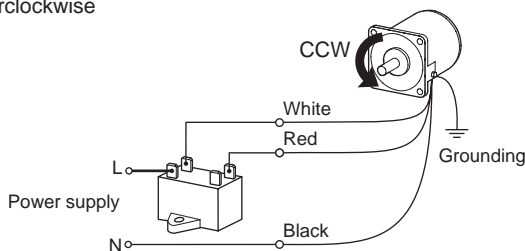
### Wiring diagram

The connection method will vary depending on the direction. The direction of motor rotation is as viewed from the side of the motor's output shaft. The motor rotates in a clockwise (CW) and counterclockwise (CCW) direction.

Clockwise



Counterclockwise

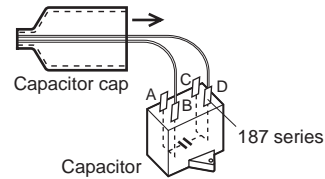


### Capacitor connection

The capacitor internal wiring as follows:

Capacitor terminals are internally electrically connection in twos; A-B and C-D for easy connection. For easy to install terminals use 187 series FASTON terminals (TE Connectivity).

Use the supplied capacitor cap to insulate the capacitor terminal connection.



- Note** For lead wire connection, use one lead wire for each individual terminal.

### Connecting Protective Earth Terminal

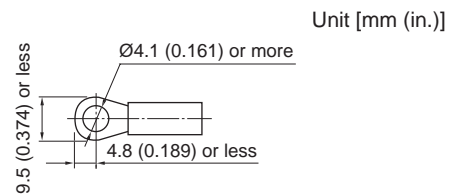
Ground the motor using the motor's Protective Earth Terminal  $\perp$ .

Applicable crimp terminal: Round crimp terminal with insulation cover

Thread size of terminal: M4

Tightening torque: 1.0 to 1.3 N·m (8.8 to 11.5 lb-in)

Applicable lead wire: AWG18 (0.75 mm<sup>2</sup>) or thicker



- Note** Do not use screws other than the protective earth terminal screws attached on the product.

### Time rating

The time rating will vary, depending on the impressed voltage.

Specification	Voltage	Rating
Single-phase 100 V specification	100 V	Five-minute
	50 V	Continuous
Single-phase 110/115 V specification	110/115 V	Five-minute
	60 V	Continuous
Single-phase 200 V specification	200 V	Five-minute
	100 V	Continuous
Single-phase 220/230 V specification	220/230 V	Five-minute
	115 V	Continuous

Continuous ratings: The motors can be operated continuously.

Five-minute ratings: The motors can be operated continuously for five minutes.

### Locked rotor burnout protection

This motor is equipped with the feature listed below to prevent the motor from burning out as a result of abnormal heating which may be caused by misapplication.

### Thermal protection

"TP" is stamped on the motor nameplate. The motor has an "auto reset" type thermal protector built into its motor coil. When the motor reaches a predetermined temperature, the internal thermal protector is activated and the motor is stopped.

Always turn the power off before performing inspections.

Thermal protector activation range:

Motor type	Power is turned off	Power is turned back
3 W	130±5 °C (266±9 °F)	90±15 °C (194±27 °F)
6 to 20 W	130±5 °C (266±9 °F)	85±20 °C (185±36 °F)

## Troubleshooting

When the motor cannot be operated correctly, refer to the contents provided in this section and take appropriate action. If the problem persists, contact your nearest office.

Phenomena	Check items
Motor does not rotate or rotates slowly.	<ul style="list-style-type: none"> <li>• Check the power supply voltage.</li> <li>• Connect the power supply and the motor correctly.</li> <li>• Connect the supplied capacitor correctly.</li> <li>• If terminal blocks or crimp terminals are used, check them for poor connection.</li> <li>• Keep the load at or below the allowable value.</li> </ul>
Motor sometimes rotates and stops.	<ul style="list-style-type: none"> <li>• Connect the power supply and the motor correctly.</li> <li>• Connect the supplied capacitor correctly.</li> <li>• If terminal blocks or crimp terminals are used, check them for poor connection.</li> </ul>
The motor rotates in the direction opposite to the specified direction.	<ul style="list-style-type: none"> <li>• Connect correctly by referring to "Wiring diagram."</li> <li>• Connect the supplied capacitor correctly.</li> <li>• The rotating direction of the motor output shaft may be different from that of the gearhead output shaft depending on the gear ratio of the gearhead. Refer to "Rotating direction of the gearhead output shaft" on p.3.</li> <li>• The rotating direction is indicated as viewed from the motor output shaft. Check the reference direction.</li> </ul>
Motor temperature abnormally high. [Motor case temperature exceeds 90 °C (194 °F).]	<ul style="list-style-type: none"> <li>• Check the power supply voltage.</li> <li>• Is the motor constrained or used continuously at a voltage exceeding the rated continuous voltage?</li> <li>• Connect the supplied capacitor correctly.</li> <li>• Review the ventilation condition.</li> </ul>
Noisy operation.	<ul style="list-style-type: none"> <li>• Assemble the motor and gearhead correctly by referring to the operating manual for the gearhead.</li> <li>• Check if the gearhead has the same gear-tooth profile as the motor.</li> </ul>

## Maintenance and inspection

### ■ Inspection

It is recommended that periodic inspections would be conducted for the items listed below after each operation of the motor. If an abnormal condition is noted, discontinue any use and contact your nearest Oriental Motor sales office.

#### ● Inspection item

- Check if any of the mounting screws of the motor and gearhead is loose.
- Check if the bearing part (ball bearings) of the motor generates unusual noises.
- Check if the bearing part (ball bearings) or gear meshing part of the gearhead generates unusual noises.
- Check if the output shaft of the motor and gearhead and a load shaft are out of alignment.

### ■ Warranty

Check on the Oriental Motor Website for the product warranty.

### ■ Disposal

Dispose the product correctly in accordance with laws and regulations, or instructions of local governments.

## Regulations and standards

Check on the Oriental Motor Website for the regulations and standards.

### ■ UL Standards, CSA Standards

This product is recognized by UL under UL and CSA Standards.

### ■ China Compulsory Certification System (CCC System)

This product is affixed with the CCC Mark under the China Compulsory Certification System. It is also certified by CQC.

### ■ CE Marking

This product is affixed with the marks under the following directives.

#### ● Low Voltage Directive

Installation conditions

Overvoltage category II, Pollution degree 2, Class I equipment

If the overvoltage category III and pollution degree 3 are required for the equipment, install the motor in an enclosure whose degree of protection is equivalent to IP54 or higher, and supply a rated voltage to the motor via the insulation transformer.

### ■ Motor temperature rise tests

Temperature rise tests required by the standards are conducted for the pinion shaft type motors in a state of attaching a gearhead. The tests for the round shaft type motors are conducted in a state of attaching a heat radiation plate. The size, thickness and material of the heat radiation plates are as follows.

Model	Size [mm (in.)]	Thickness [mm (in.)]	Material
2TK	115 × 115 (4.53 × 4.53)	5 (0.20)	Aluminum alloy
3TK	125 × 125 (4.92 × 4.92)		
4TK	135 × 135 (5.31 × 5.31)		
5TK	165 × 165 (6.50 × 6.50)		

### ■ RoHS Directive

This product does not contain the substances exceeding the restriction values.

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