

## OPERATING MANUAL

### World K Series Terminal Box Type 6 W

Induction Motors and Reversible Motors



#### Introduction

##### ■ Before using the motor

Only qualified personnel 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.

#### Regulations and standards

##### ■ UL Standards, CSA Standards, CCC System

This product is recognized by UL under the UL and CSA Standards, and also certified by CQC under the China Compulsory Certification (CCC) system. The motor model name represents the model that conforms to the standards.

Applicable standards	Certification Body / File No.
UL 1004-1, UL 1004-2	UL /UL File No.E64199
CSA C22.2 No.100, CSA C22.2 No.77	
GB/T 12350	CQC

- Thermal Class: 130 (B)

##### ● Standards for accessories

Capacitor: UL File No.E83671 (CYWT2),  
VDE License Nos.112847 (capacitors with a rated voltage of 250 VAC),  
114747 (capacitors with a rated voltage of 450 VAC)  
Capacitor cap: UL File No.E56078 (YDTU2)

##### ■ CE Marking

This product is affixed the CE Marking under the Low Voltage Directive.

##### ● Low Voltage Directive

- Applications standards  
EN 60034-1, EN 60034-5, EN 60664-1, EN 60950-1

##### ● Installation conditions (For EN standard)

Overvoltage category II, Pollution degree 3 (except for the motor mounting surface), Class I equipment

##### ● 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. Heat radiation plate size: 115×115 mm (4.53×4.53 in.), thickness: 5 mm (0.20 in.), material: aluminum alloy

##### ■ Electrical Appliance and Material Safety Law

The three-phase round shaft motor type bears a mark.

##### ■ RoHS Directive

The products do not contain the substances exceeding the restriction values of RoHS Directive (2011/65/EU).

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.

#### 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.
- The motor is class I equipment. Install the motor so as to avoid contact with hands, or ground it to prevent the risk of 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 connection 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.

#### **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 burn.
- Do not hold the motor output shaft. This may cause injury.
- Keep the area around the motor free of combustible materials in order to prevent fire or a burn.
- 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.
- When an abnormality is noted, turn off the power immediately, or fire, electric shock or injury may occur.
- The motor surface temperature may exceed 70 °C (158 °F) even under normal operating conditions. If the operator is allowed to approach the running motor, attach a warning label as shown in the figure in a conspicuous position. Failure to do so may result in a 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.....1 unit
- Capacitor.....1 piece (only for single-phase motors)
- Capacitor cap .....1 piece (only for single-phase motors)
- Mounting screw set .....1 set (only for combination type)  
Mounting screw, nut, washer 4 pieces each
- Instructions and Precautions for Safe Use .....1 copy (this document)

### ■ Checking the model name

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

Combination type:

The box (□) of the model will be filled with the numeral to represent the gear reduction ratio. Gearheads are sold separately.

Pinion shaft type, round shaft type:

The list above shows pinion shaft motors. For the round shaft motor, "GN" in the model and motor model are replaced by "A".

Refer to p.3 for the connection diagram.

#### ● Induction motors

##### Single-phase type (Connection diagram: ①)

##### Combination type

Model	Motor model	Capacitor model	Gearhead model
2IK6AB-□S	2IK6GN-AW2B	CH35FAUL2	2GN□S
2IK6FB-□S		CH25FAUL2	
2IK6CB-□S	2IK6GN-CW2B	CH08BFAUL	
2IK6EB-□S		CH06BFAUL	

##### Pinion shaft type, round shaft type

Model	Motor model	Capacitor model
2IK6GN-AW2BJ	2IK6GN-AW2B	CH35FAUL2
2IK6GN-AW2BU		CH25FAUL2
2IK6GN-CW2BJ	2IK6GN-CW2B	CH08BFAUL
2IK6GN-CW2BE		CH06BFAUL

##### Three-phase type (Connection diagram: ②)

##### Combination type

Model	Motor model	Gearhead model
2IK6SB-□S	2IK6GN-SW2B	2GN□S

##### Pinion shaft type, round shaft type

Model	Motor model
2IK6GN-SW2B	2IK6GN-SW2B

#### ● Reversible motors

##### Single-phase type (Connection diagram: ③)

##### Pinion shaft type, round shaft type

Model	Motor model	Capacitor model
2RK6GN-AW2BJ	2RK6GN-AW2B	CH45FAUL2
2RK6GN-AW2BU		CH35FAUL2
2RK6GN-CW2BJ	2RK6GN-CW2B	CH10BFAUL
2RK6GN-CW2BE		CH08BFAUL

## Installation

### ■ Location for installation

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)  
100 V/200 V: -10 to +50 °C (+14 to +122 °F) (non-freezing)
- Operating ambient humidity 85%, maximum (non-condensing)
- Area that is free from an explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- Area not exposed to direct sun
- Area free of excessive amount dust, iron particles or the like
- Area not subject to splashing water (storms, 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 (3300 ft.) or less above sea level

#### Note

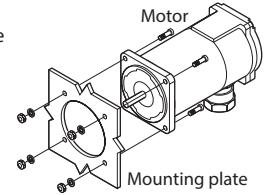
On rare occasions, grease may ooze out from the gearhead. If there is a concern over possible environmental damage resulting from the leakage of grease, provide an oil tray or similar oil catching mechanism in order not to cause a secondary damage. Grease leakage may lead to problems in the customer's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

### ■ How to install the motor

#### ● Round shaft type

Drill holes on the mounting plate and fix the motor on the plate using screws (not supplied). Do not leave a gap between the motor and mounting plate.

Nominal diameter of screw	Tightening torque [N·m (lb·in)]
M4	2.0 (17.7)

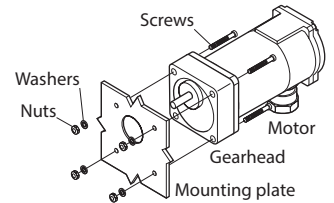


#### Note

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.

#### ● Combination type

Drill holes on the mounting plate and fix the motor and gearhead on the plate using screws supplied. Do not leave a gap between the motor and mounting plate. Refer to the Oriental Motor Website for the screw specifications.



### ■ Installing/removing the gearhead

This is a procedure for when the gearhead is replaced or the seal connector position is changed to a desired 90° direction.

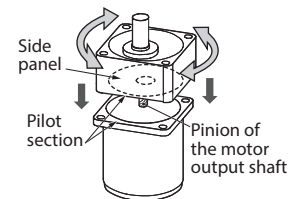
#### Removing the gearhead from the motor

Remove the hexagonal socket head screws (2 pieces) assembling the motor and gearhead and detach the motor from the gearhead.



#### Installing the gearhead to the motor

1. Keep the pilot sections of the motor and gearhead in parallel, and assemble the gearhead with the motor while slowly rotating it clockwise/counterclockwise. At this time, note so that the pinion of the motor output shaft does not hit the side panel or gears of the gearhead strongly.
2. Check no gaps remain between the motor and gearhead, and tighten them with hexagonal socket head screws (2 pieces).



Assemble the gearhead to the motor in a condition where the motor output shaft is in an upward direction.



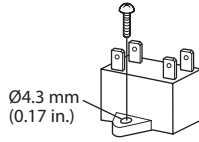
- Use the gearhead with pinion shaft which is identical with one of motor.
- Do not forcibly assemble the motor and gearhead. Also, prevent metal objects or foreign substances from entering in the gearhead. The pinion of the motor output shaft or gear may be damaged, resulting in noise or shorter service life.
- O-rings are attached on the motor flange and the mounting surface of the decimal gearhead. Install the gearhead so as not to pinch the O-rings. Grease in the gearhead may leak.

### Pinion shaft type

Pinion-shaft motors are used with a gearhead assembled (see the figure above).

### Mounting the capacitor (only for single-phase motors)

Before mounting the provided 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).



- 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

Insulate all the wire connections, such as the connection between the motor and the capacitor connection. Ground the motor using a Protective Earth Terminal.

### 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.

Gear ratio	Rotating direction of the gearhead output shaft
3 to 18 50 to 180	Same as the rotating direction of motor shaft
25 to 36	Opposite the rotating direction of motor shaft

### Connection diagram

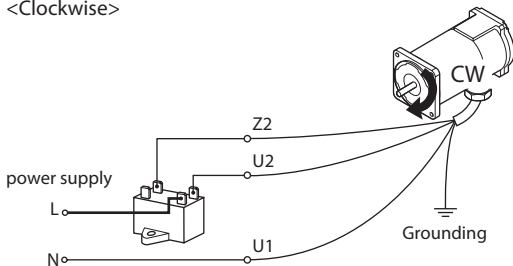
Check the motor model name used before connecting.

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. Z2, U2, U1, U, V, and W in the connection diagram indicate terminal codes inside the terminal box.

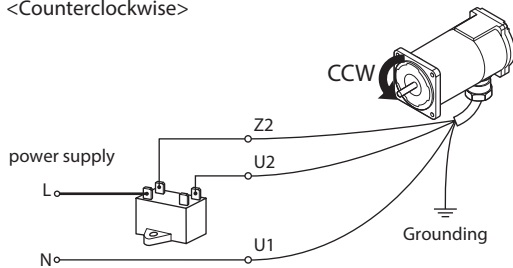
### Induction motors

#### Single-phase type (Connection diagram: ①)

<Clockwise>

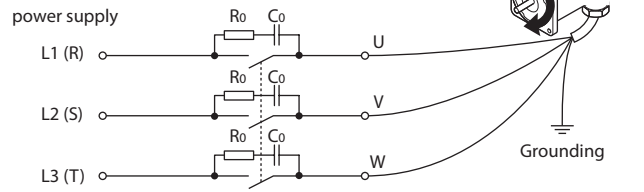


<Counterclockwise>



#### Three-phase type (Connection diagram: ②)

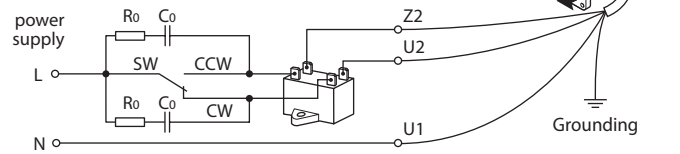
The motor rotates in the clockwise direction (CW) if connected as the connection diagram below. To change the direction of rotation, change any two connections between R, S and T.



### Reversible motors

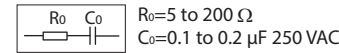
#### Single-phase type (Connection diagram: ③)

The motor rotates in the clockwise direction if the switch (SW) is connected to the CW side, and it rotates in the counterclockwise direction if connected to the CCW side.



### For protection of contact (switch)

If the switch is used for starting/stopping the motor or switching the rotation direction, connect the CR circuit for surge suppression in order to protect the contacts.



It is provided as an accessory (sold separately).

Model: EPCR1201-2

### Lead Wire for Power Supply

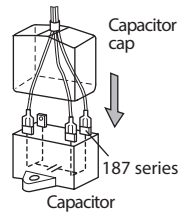
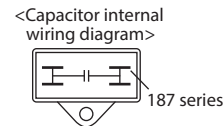
Use a lead wire of AWG20 (0.5 mm<sup>2</sup>) or thicker.

### Capacitor connection (only for single-phase motors)

When crimp terminals are used, use the FASTON terminals 187 Series (TE Connectivity).

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

The capacitor has four terminals that are internally connected as shown in the figure.



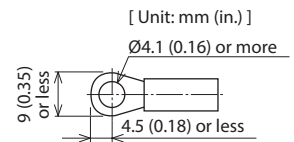
For lead wire connection, use one lead wire for each individual terminal.

### Connecting Protective Earth Terminal

Ground the motor using the motor's Protective Earth Terminal ⊕.

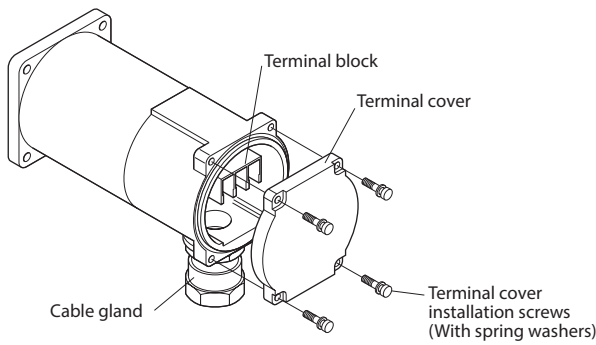
Applicable crimp terminal:  
Insulated round crimp terminal  
Terminal screw size: M4

Tightening torque:  
1.0 to 1.3 N·m (8.8 to 11.5 lb-in)  
Applicable minimum lead wire size:  
AWG18 (0.75 mm<sup>2</sup>) or thicker

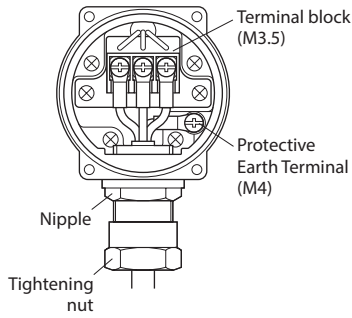


Be sure to use the screw for grounding attached on the product.

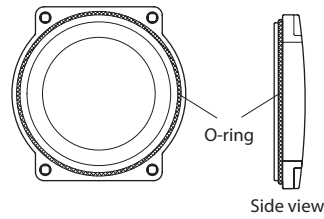
## ■ Connection method to a terminal box



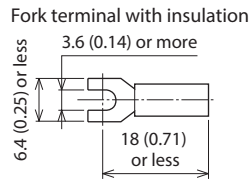
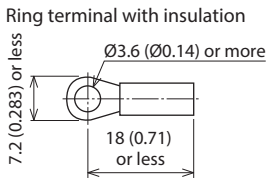
### Layout of terminals



### Rear side of terminal cover



- Use a cable (not supplied) of the following specifications:  
Applicable cable diameter:  $\varnothing 8$  to 12 mm ( $\varnothing 0.31$  to 0.47 in.)  
Applicable lead wire: AWG18 (0.75 mm<sup>2</sup>) or thicker
- When connecting the cable on the terminal block, use the following crimp terminal. [Unit: mm (in.)]



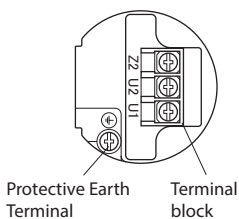
- When sealing the terminal cover, ensure that no scraps or particles get caught between the contact surfaces.
- This terminal cover is constructed to hold a O-ring. If this gasket comes out of the cover, please reseal it correctly on the cover.
- Refer to the tightening torque table to determine the appropriate tightening torque to use when fastening the terminal cover and cable gland. Loosening and then tightening the nut again may cause the nipple to become loose. In this case, securely tighten the nipple again to the applicable torque specified in the table below.

Terminal cover	0.5 to 0.7 N·m (4.4 to 6.1 lb-in)
Cable gland (Tightening nut)	3.2 to 8.0 N·m (28 to 70 lb-in)
Cable gland (Nipple)	8 to 10 N·m (70 to 88 lb-in)
Terminals block	0.8 to 1.0 N·m (7.0 to 8.8 lb-in)

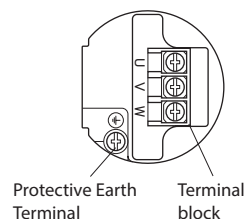
- Note**
- To make shielding function fully effective, use a cable of an appropriate diameter.
  - Securely affix the cable exposed outside the motor so that it does not receive stress.

### ● Layout of terminals

#### Single-phase type



#### Three-phase type



## Operation

The motor rotates when the power supply is turned on. For protection against electric shock, do not turn on the power supply until the wiring is complete.

### Note

- Make sure that the motor case temperature does not exceed 90 °C (194 °F) when operating 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 of the single-phase induction motor, wait until the motor completely stops. Otherwise its direction may not change or may take much time to change.
- Do not perform an operation switching the motor rotation direction instantaneously with three-phase motors. Doing so may cause damage to the motor and gearhead.
- Single-phase motors use a capacitor and keep it connected even after rotation of the motor has started.

## Time rating

### ● Induction motors

Induction motors have a continuous rating.

### ● Reversible motors

Reversible motors have a 30 minutes rating. "30 min" is indicated on the nameplate.

## Maintenance · 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 are 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.

## 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.

### ■ Impedance protection

"ZP" is stamped on the motor nameplate. The motor has higher coil impedance. When the motor goes into locked rotor condition due to a malfunction, coil impedance rises, suppressing input power to the motor and protecting the motor coil from burnout.

## 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>• With a single-phase motor, 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>• With a single-phase motor, 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 "Connection diagram."</li> <li>• With a single-phase motor, 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. See "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>• With a single-phase motor, 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.</li> <li>• Assemble a gearhead of the same pinion type as the motor.</li> </ul>

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