2-Phase Stepping Motor
PKP Series SH Geared Type

Before use
Only qualified personnel of electrical and mechanical engineering should work with the product. Use the product correctly after thoroughly reading the “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.

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.

Description of signs

**WARNING**
Handling the product without observing the instructions that accompany a “Warning” symbol may result in serious injury or death.

**CAUTION**
Handling the product without observing the instructions that accompany a “Caution” symbol may result in injury or property damage.

**Note**
The items under this heading contain important handling instructions that the user should observe to ensure the safe use of the product.

Description of graphic symbols

- Indicates “prohibited” actions that must not be performed.
- Indicates “compulsory” actions that must be performed.

**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. This may cause fire or injury.
- Do not forcibly bend, pull or pinch the motor lead wire or cable. This may cause fire.
- Do not disassemble or modify the product. This may cause injury.
- Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. If this product is used in a vertical application, be sure to provide a measure for the position retention of moving parts. Failure to do so may result in injury or damage to equipment.
- If this product is used in a vertical application, be sure to provide a measure for the position retention of moving parts. Failure to do so may result in injury or damage to equipment.
- Install the product in an enclosure. Failure to do so may result in injury.
- Connect the cables securely according to the wiring diagram. Failure to do so may result in fire.
- For the power supply, use a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may cause electric shock.

**CAUTION**
- Do not use the product beyond its specifications. This may cause injury or damage to equipment.
- Keep your fingers and objects out of the openings in the product. Failure to do so may result in fire or injury.
- Do not touch the product while operating or immediately after stopping. This may cause a skin burn(s).
- Do not carry the motor by holding the motor output shaft, motor lead wire or cable. Doing so may cause injury.
- Keep the area around the product free of combustible materials. Failure to do so may result in fire or a skin burn(s).
- Leave nothing around the product that would obstruct ventilation. Failure to do so may result in damage to equipment.
- Do not touch the rotating part (output shaft) while operating the motor. Doing so may result in injury.
- Provide a cover over the rotating part (output shaft) of the motor. Failure to do so may result in injury.
- Use a motor and driver only in the specified combination. Failure to do so may result in fire.
- Provide an emergency stop device or emergency stop circuit so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury.
- When an abnormal condition has occurred, immediately stop operation and turn off the driver power. Failure to do so may result in fire or injury.
- 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 below in a conspicuous position. Failure to do so may result in a skin burn(s).

Precautions for use
- When conducting the insulation resistance measurement and the dielectric strength test, be sure to separate the connection between the motor and the driver. Conducting the insulation resistance measurement or withstand voltage test with the motor and driver connected may result in injury or damage to equipment.
- Do not apply a radial load and axial load in excess of the specified permissible limit. Operating the motor under an excessive radial load or axial load may damage the motor bearings (ball bearings). Be sure to operate the motor within the specified permissible limit of radial load and axial load.
- Motor surface temperature
  The surface temperature on the motor case may exceed 100 °C (212 °F) depending on operating conditions such as ambient temperature, operating speed, duty cycle and others. To prevent the motor bearings (ball bearings) from reaching its usable life quickly, use the motor in conditions where the surface temperature will not exceed 70 °C (158 °F). Use the geared motor in a condition where the gear case temperature does not exceed 70 °C (158 °F), in order to prevent deterioration of grease and parts in the gear part.
- Grease leakage
  On rare occasions, a small amount of grease may ooze out from the geared motor. If there is concern over possible environmental damage resulting from the leakage of grease, check for grease stains during regular inspections. Alternatively, install an oil pan or other device to prevent leakage from causing further damage. Oil leakage may lead to problems in the customer’s equipment or products.

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.
• **Holding torque at standstill**
  The motor holding torque is reduced by the current cutback function of the driver at motor standstill. When operating the motor, take account of the motor torque drop at the time of stopping.

• **Allowable torque**
  When operating the motor at a constant speed, use so that the torque does not exceed the allowable torque in the specifications. Operating the motor in excess of the allowable torque may cause damage to the gear part.

• **Speed range**
  Operate the motor at speeds within the speed range. Operating the motor at a speed outside the speed range may result in a shorter gear life.

• **Backlash**
  The gear output shaft is subject to backlash. To reduce the effect of backlash, perform positioning operations from one direction only—either from the CW direction or the CCW direction.

• **Rotating direction of the gear output shaft**
  The relationship between the rotating direction of the motor shaft and that of the gear output shaft changes as follows, depending on the gear type and gear ratio.

<table>
<thead>
<tr>
<th>Model</th>
<th>Gear ratio</th>
<th>Rotation direction of the gear output shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td>PKP223</td>
<td>7.2, 36</td>
<td>Same as the motor output shaft</td>
</tr>
<tr>
<td></td>
<td>9, 10, 18</td>
<td>Opposite to the motor output shaft</td>
</tr>
<tr>
<td>PKP243</td>
<td>3.6, 7.2, 9, 10</td>
<td>Same as the motor output shaft</td>
</tr>
<tr>
<td>PKP264</td>
<td>18, 36</td>
<td>Opposite to the motor output shaft</td>
</tr>
</tbody>
</table>

### 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
  - Connection cable [0.6 m (2 ft.)]: 1 pc.
  - Operating MANUAL: 1 copy (this document)

- **How to identify the product name**
  Check the model number of the motor against the number shown on the nameplate.

```
PKP2 D - SG - L
```

<table>
<thead>
<tr>
<th>Motor frame size</th>
<th>1: 28 mm (1.10 in.)</th>
<th>2: 42 mm (1.65 in.)</th>
<th>3: 60 mm (2.36 in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor length</td>
<td>4: 5 pcs.</td>
<td>5: 6 pcs.</td>
<td>6: 7 pcs.</td>
</tr>
<tr>
<td>Number of lead wire</td>
<td>7: 8 pcs.</td>
<td>8: 9 pcs.</td>
<td>9: 10 pcs.</td>
</tr>
<tr>
<td>Motor winding specification</td>
<td>A: Single shaft</td>
<td>B: Double shaft</td>
<td></td>
</tr>
<tr>
<td>Motor identification</td>
<td>2: Model A</td>
<td>None: Model B</td>
<td></td>
</tr>
<tr>
<td>Gear type</td>
<td>SG: SH geared type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gear ratio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection cable</td>
<td>L: Supplied with a connection cable</td>
<td>None: Without connection cable</td>
<td></td>
</tr>
</tbody>
</table>

### Names of parts

- **Connection cable**
  - Unipolar 5 lead wires type
  - Bipolar 4 lead wires type

### Wiring connection diagram

- **Applicable connector/lead wire**
  - Connector housing: MDF97-5S-3.5C (HIROSE ELECTRIC CO., LTD.)
  - Contact: MDF97-22SC (HIROSE ELECTRIC CO., LTD.)
  - Designated crimping tool: HT801/MDF97-22S (HIROSE ELECTRIC CO., LTD.)
  - Applicable lead wire:
    - AWG22 (0.3 mm²)
    - Outer sheath diameter: ø1.2 to 1.5 mm (ø0.047 to 0.059 in.)
    - Strip length of the insulation cover: 1.8 to 2.3 mm (0.071 to 0.091 in.)

### Motors of Model A

- **Connection cable**
  - Motor lead wires
  - Output shaft
  - Mounting holes (4 places)
  - Connector
  - Pin No. 1
  - Pin No. 2
  - Pin No. 3
  - Pin No. 4
  - Pin No. 5

### Motors of Model B

- **Connection cable**
  - Motor lead wires
  - Output shaft
  - Mounting holes (4 places)
  - Connector
  - Pin No. 1
  - Pin No. 2
  - Pin No. 3
  - Pin No. 4

- **Wiring connection diagram**
  - Unipolar 6 lead wires type
  - Bipolar 4 lead wires type

* The pin Nos. 2 and 5 are not used for the 4 lead wires type.
Applicable connector/lead wire

<table>
<thead>
<tr>
<th>Motor model</th>
<th>Type</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector housing</td>
<td>51065-0600</td>
<td>(Molex)</td>
</tr>
<tr>
<td>Contact</td>
<td>50212-8XXX</td>
<td>(Molex)</td>
</tr>
<tr>
<td>Designated crimping tool</td>
<td>63819-0500</td>
<td>(Molex)</td>
</tr>
</tbody>
</table>

PKP223

Applicable lead wire

- When the current value is less than 1 A/phase: AWG28 to 24 (0.08 to 0.2 mm²)
- When the current value is 1 A/phase or more: AWG26 to 24 (0.14 to 0.2 mm²)
- Strip length of the insulation cover: 1.3 to 1.8 mm (0.051 to 0.071 in.)
- Outer sheath diameter: ø0.8 to 1.4 mm (ø0.031 to 0.055 in.)

PKP243

Applicable lead wire

- When the current value is less than 1.5 A/phase: AWG28 to 22 (0.08 to 0.3 mm²)
- When the current value is 1.5 A/phase or more: AWG26 to 22 (0.14 to 0.3 mm²)
- Strip length of the insulation cover: 2.3 to 2.8 mm (0.091 to 0.11 in.)
- Outer sheath diameter: ø1.15 to 1.8 mm (ø0.045 to 0.071 in.)

PKP264

Applicable lead wire

- AWG24 to 18 (0.2 to 0.75 mm²)
- Outer sheath diameter: ø1.4 to 3 mm (ø0.055 to 0.118 in.)
- Strip length of the insulation cover: 3 to 3.5 mm (0.118 to 0.138 in.)

Connection

When inserting the connector
Hold the connector main body, and insert it in straight securely. Inserting the connector in an inclined state may result in damage to connector or a connection failure.

When pulling out the connector
Pull out the connector in straight while releasing the lock part of the connector. Having the motor lead wires or pulling out the connector in a state of being locked may damage the connector.

Connection with the drivers of Oriental Motor

Refer to the following table when connecting with the drivers of Oriental Motor. "Color" in the table represents the colors of lead wires of the connection cable (supplied or accessory).

- The motors of the model A and model B are different in pin assignments. Wrong connection will not cause the motor to operate properly.

Connection with the CVD driver

<table>
<thead>
<tr>
<th>Driver CN2 Pin No.</th>
<th>Model A</th>
<th>Model B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Connection with the CMD driver

<table>
<thead>
<tr>
<th>Driver CN3 Pin No.</th>
<th>Model A</th>
<th>Model B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Yellow</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

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 +50 °C (+14 to +122 °F) (non-freezing)
- 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 (rains, 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
- 1,000 m (3,300 ft) or lower above sea level
**Installation method**

Install the motor onto an appropriate flat metal plate having excellent vibration resistance and heat conductivity. When installing the motor, secure it with four screws (not supplied) through the four screw holes provided. Leave no gap between the motor and plate.

**Installing a load**

When connecting a load to the motor, align the centers of the motor's output shaft and load shaft. Be careful not to damage the output shaft or the bearings when installing a coupling or pulley to the motor's output shaft.

**Permissible radial load and permissible axial load**

The radial load and axial load on the motor output shaft must be kept under the permissible values listed below.

### Permissible radial load

<table>
<thead>
<tr>
<th>Model</th>
<th>Nominal size</th>
<th>Tightening torque [N·m (oz-in.)]</th>
<th>Effective depth of screw thread [mm (in.)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PKP223</td>
<td>M2.5 P0.45</td>
<td>0.5 (21)</td>
<td>4 (0.157)</td>
</tr>
<tr>
<td>PKP243</td>
<td>M3 P0.5</td>
<td>1 (142)</td>
<td>7 (0.278)</td>
</tr>
<tr>
<td>PKP264</td>
<td>M4 P0.7</td>
<td>2 (280)</td>
<td>8 (0.315)</td>
</tr>
</tbody>
</table>

**Permissible axial load**

<table>
<thead>
<tr>
<th>Model</th>
<th>Permissible axial load [N (lb.)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PKP223</td>
<td>10 (2.2)</td>
</tr>
<tr>
<td>PKP243</td>
<td>15 (3.3)</td>
</tr>
<tr>
<td>PKP264</td>
<td>30 (6.7)</td>
</tr>
</tbody>
</table>

**Maintenance/inspection**

### Inspection

It is recommended that periodic inspections 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 office.

- Are any of motor mounting screws loose?
- Are there any abnormal noises in the motor bearings (ball bearings) or other moving parts?
- Are there any scratches, signs of stress in the motor lead wires?
- Are there any loose connections on the connector or driver?
- Are the motor's output shaft and load shaft out of alignment?

### Warranty

Check on the Oriental Motor Website or General Catalog for the product warranty.

### Disposal

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

**Specifications**

Check on the Oriental Motor Website for the product specifications.

**General specifications**

<table>
<thead>
<tr>
<th>Degree of protection</th>
<th>IP20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation environment</td>
<td>Ambient temperature −10 to +50 °C (+14 to +122 °F) (non-freezing)</td>
</tr>
<tr>
<td>Humidity</td>
<td>85% or less (non-condensing)</td>
</tr>
<tr>
<td>Altitude</td>
<td>Up to 1,000 m (3,300 ft.) above sea level</td>
</tr>
<tr>
<td>Surrounding atmosphere</td>
<td>No corrosive gas, dust, water or oil</td>
</tr>
<tr>
<td>Storage environment, Shipping environment</td>
<td>Ambient temperature −20 to +60 °C (−4 to +140 °F) (non-freezing)</td>
</tr>
<tr>
<td>Humidity</td>
<td>85% or less (non-condensing)</td>
</tr>
<tr>
<td>Altitude</td>
<td>Up to 3,000 m (10,000 ft.) above sea level</td>
</tr>
<tr>
<td>Surrounding atmosphere</td>
<td>No corrosive gas, dust, water or oil</td>
</tr>
</tbody>
</table>

**Diode strength**

Sufficient to withstand the following conditions applied between the winding and the case for 1 minute:
- PKP23, PKP24: 0.5 kVAC, 50/60 Hz
- PKP26: 1.0 kVAC, 50/60 Hz

**Regulations and standards**

**RoHS Directive**

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

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**Maintenance/inspection**

### Inspection

It is recommended that periodic inspections 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 office.

**During inspection**

- Are any of motor mounting screws loose?
- Are there any abnormal noises in the motor bearings (ball bearings) or other moving parts?
- Are there any scratches, signs of stress in the motor lead wires?
- Are there any loose connections on the connector or driver?
- Are the motor's output shaft and load shaft out of alignment?

### Warranty

Check on the Oriental Motor Website or General Catalog for the product warranty.

### Disposal

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