



OPERATING MANUAL

5-Phase Stepping Motor PKP Series TS Geared Type

Introduction

■ 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

	Handling the product without observing the instructions that accompany a "WARNING" symbol may result in serious injury or death.
	Handling the product without observing the instructions that accompany a "CAUTION" symbol may result in injury or property damage.
	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	
	<ul style="list-style-type: none"> 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 lead wire or cable. This may cause fire. Do not disassemble or modify the product. This may cause 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.

WARNING	
	<ul style="list-style-type: none"> Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so may result in fire or injury. 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	
	<ul style="list-style-type: none"> 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, 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.
	<ul style="list-style-type: none"> 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 external to the equipment 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).



Warning label

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 test or dielectric strength test with the motor and driver connected may result in damage to the product.

- 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 motor surface temperature may exceed 100 °C (212 °F) under certain conditions (operating ambient temperature, operating speed, duty cycle, etc.). To prevent the bearings (ball bearings) from reaching its usable life quickly, use the motor in a condition where the surface temperature does not exceed 100 °C (212 °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.

- 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.

- Peak torque

Operate the motor so that the sum of the acceleration/deceleration torque at the starting/stopping of the motor and the load (friction) torque does not exceed the peak torque in the specifications. Operating the motor in excess of the peak 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.

- Rotation direction of the gear output shaft

The relationship between the rotation direction of the motor output shaft and that of the gear output shaft changes as follows, depending on the gear ratio.

Gear ratio	Rotation direction of the gear output shaft
3.6, 7.2, 10	Same as the motor output shaft
20, 30	Opposite as the motor output shaft

- Make sure to provide measures so that the key is not flown off when operating the motor with key in a state where a load is not installed.

Flying off the key may result in injury or damage to equipment.

Preparation

■ Checking the product

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

- Motor 1 unit
- Parallel key 1 pc. (Supplied with **PKP56**)
- Motor mounting screw set..... 1 bag (Supplied with **PKP56**)
[Packing contents] Screw.....4 pcs. [M4x60 mm (2.36 in.)]
Washer.....4 pcs.
Spring washer.....4 pcs.
- Instructions and Precautions for Safe Use 1 copy

■ How to identify the product model

Check the model number of the motor against the number shown on the nameplate.

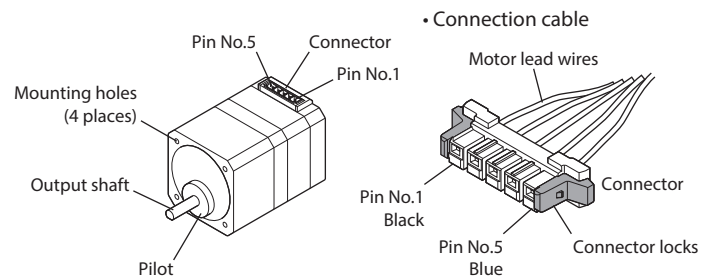
PKP5 **N** **A** **2** - **TS**

1 2 3 4 5 6 7 8

1	Motor frame size	4 : 42 mm (1.65 in.) 6 : 60 mm (2.36 in.)
2	Motor length	
3	Number of lead wire	N : 5 pcs.
4	Motor winding specification	18 : Rated current 1.8 A/phase 28 : Rated current 2.8 A/phase
5	Shape	A : Single shaft B : Double shaft
6	Reference number	
7	Type of gear	TS : TS geared type
8	Gear ratio	

■ Names of parts

The pin numbers as well as the colors of lead wires are shown in the figures.



Pin assignment

Pin No.	Lead wire color *
5	Blue
4	Red
3	Orange
2	Green
1	Black

* The colors of lead wires show arrangement of colors of our connection cable.

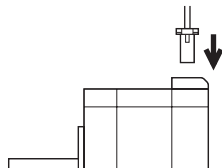
Applicable connector/lead wire

Type	Model
Connector housing	MDF97A-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	<ul style="list-style-type: none"> – AWG24 to 22 (0.2 to 0.3 mm²) – Outer sheath diameter: $\phi 1.24$ to 1.38 mm ($\phi 0.049$ to 0.054 in.) – Strip length of the insulation cover: 1.8 to 2.3 mm (0.071 to 0.091 in.)

Connection

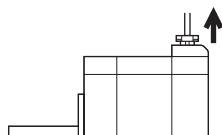
• When inserting the connector

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.



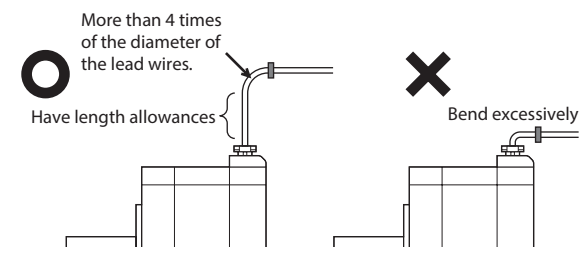
• When pulling out the connector

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.



Note

Secure the lead wires at the connection part to prevent the connection part from receiving stress due to the flexing of the lead wires or the lead wires' own mass. Also, do not excessively bend the lead wires near the connection part of the connector. Applying stress on the motor lead wires may cause poor contact or disconnection, leading to malfunction or heat generation.



■ 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 our connection cable.

• Connection with the CVD Series

Driver CN2 Pin No.	Pin No.	Color
1	5	Blue
2	4	Red
3	3	Orange
4	2	Green
5	1	Black

Installation

■ Location for installation

The motor has been designed and manufactured to be incorporated 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 (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
- 1,000 m (3,300 ft.) or lower above sea level

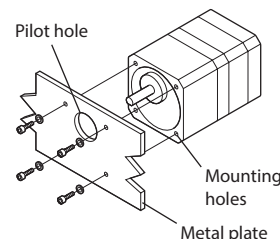
■ Installation method

The motor can be installed in any direction.

Install the motor onto an appropriate flat metal plate having excellent vibration resistance and heat conductivity.

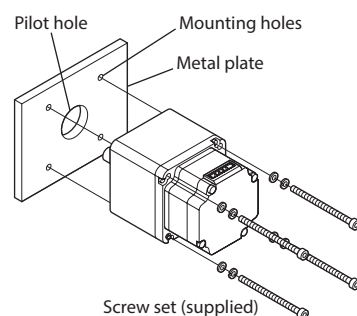
When installing the motor, secure it with four bolts through the four mounting holes provided. Do not leave a gap between the motor and metal plate. The PKP56 come with a motor mounting screw set.

• PKP54



• PKP56

Secure the motor using the supplied screw set. [Screw size: M4x60 mm (2.36 in.)]



Model	Nominal size	Tightening torque [N·m (oz·in)]	Effective depth of screw thread [mm (in.)]
PKP54	M4	2 (280)	8 (0.315)
PKP56			—

Values of the tightening torque are recommended. Tighten the screws with a suitable torque according to the design conditions of the metal plate to be installed.

Note

Do not loosen the gear-attaching screws (4 pcs.). Doing so may cause the accuracy to drop or damage to the product.

■ Installing a load

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

■ Permissible radial load and permissible axial load

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

● Permissible radial load

Model	Gear ratio	Permissible radial load [N (lb.)]				
		Distance from the tip of motor output shaft				
		0 mm (0 in.)	5 mm (0.20 in.)	10 mm (0.39 in.)	15 mm (0.59 in.)	20 mm (0.79 in.)
PKP544	3.6, 7.2, 10	20 (4.5)	30 (6.7)	40 (9)	50 (11.2)	—
PKP543	20, 30	40 (9)	50 (11.2)	60 (13.5)	70 (15.7)	—
PKP566	3.6, 7.2, 10	120 (27)	135 (30)	150 (33)	165 (37)	180 (40)
PKP564	20, 30	170 (38)	185 (41)	200 (45)	215 (48)	230 (51)

● Permissible axial load

Model	Gear ratio	Permissible axial load [N (lb.)]
PKP544	3.6, 7.2, 10	15 (3.3)
PKP543	20, 30	
PKP566	3.6, 7.2, 10	40 (9)
PKP564	20, 30	

Maintenance/inspection

■ Inspection

It is recommended that periodic inspections are 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.

During inspection

- Check if any of the motor mounting screws come loose.
- Check if a bearing part (ball bearings) of the motor generates unusual noises.
- Check if any of the motor lead wires have a scratch or receive a stress.
- Check if the connection part with the connector or the driver comes loose.
- Check if the motor output shaft and the 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.

Specifications

Check on the Oriental Motor Website for the product specifications.

General specifications

Degree of protection		IP20
Operation environment	Ambient temperature	−10 to +50 °C (+14 to +122 °F) (non-freezing)
	Humidity	85% or less (non-condensing)
	Altitude	Up to 1,000 m (3,300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil
Storage environment, Shipping environment	Ambient temperature	−20 to +60 °C (−4 to +140 °F) (non-freezing)
	Humidity	85% or less (non-condensing)
	Altitude	Up to 3,000 m (10,000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil
Insulation resistance	100 MΩ or more when 500 VDC megger is applied between the case and motor windings.	
Dielectric strength	Sufficient to withstand the following conditions applied between the case and motor windings for 1 minute: • PKP54: 0.5 kVAC 50/60 Hz • PKP56: 1.0 kVAC 50/60 Hz	

Regulations and standards

■ RoHS Directive

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

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- Characteristics, specifications and dimensions are subject to change without notice.
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- Please contact your nearest Oriental Motor office for further information.

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