

OPERATING MANUAL

World K Series Lead Wire Type
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 1004-3	UL /
CSA C22.2 No.100, CSA C22.2 No.77	UL File No.E64197, E64199
GB/T 12350	CQC

- Thermal Class: 130 (B)
 1 W type and 3 W type motors: 105 (A) of the UL / CSA standards and 120 (E) of the CCC / EN standards

● Standards for accessories

Capacitor: UL File No.E83671 (CYWT2), VDE License Nos.112847 (capacitors with a rated voltage of 250 VAC, excluding CH10FAUL, CH12FAUL, CH15FAUL and CH18FAUL), 114747 (capacitors with a rated voltage of 450 VAC, excluding CH035BFAUL and CH045BFAUL)

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 2, Class I equipment
 When the machinery to which the motor is mounted requires overvoltage category III and pollution degree 3 specifications, install the motor in a cabinet that comply with IP54 and connect to power supply via an isolation 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.

For the 90 W reversible motors, the tests are conducted in a state of attaching a gearhead and heat radiation plate [heat radiation plate size: 200×200 mm (7.87×7.87 in.), thickness: 5 mm (0.20 in.), material: aluminum alloy].

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.

First number in motor name	Size [mm (in.)]	Thickness [mm (in.)]	Material
0	80×80 (3.15×3.15)	5 (0.20)	Aluminum alloy
2	115×115 (4.53×4.53)		
3	125×125 (4.92×4.92)		
4	135×135 (5.31×5.31)		
5 (40 W)	165×165 (6.50×6.50)		
5 (60 W, 90 W Induction motors, 150 W)	200×200 (7.87×7.87)	10 (0.39)	
5 (90 W Reversible motors)			

■ 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.

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 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. 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 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, cooling fan) 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).



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

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)
- Operating manual 1 copy (this document)

■ Checking the model name

Check the model number against the number indicated on the product. The list above shows pinion shaft motors. For the round shaft motor, "GN" and "GE" 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)

Output power	Model	Motor model	Capacitor model
1 W	01K1GN-AW2J	01K1GN-AW2	CH15FAUL
	01K1GN-AW3U	01K1GN-AW3	CH10FAUL
	01K1GN-CW2J	01K1GN-CW2	CH035BFAUL
3 W	01K3GN-BW2J	01K3GN-BW2	CH18FAUL
	01K3GN-BW3U	01K3GN-BW3	CH15FAUL
	01K3GN-DW2J	01K3GN-DW2	CH045BFAUL
6 W	21K6GN-AW2J	21K6GN-AW2	CH35FAUL2
	21K6GN-AW2U		CH25FAUL2
	21K6GN-CW2J	21K6GN-CW2	CH08BFAUL
	21K6GN-CW2E		CH06BFAUL
15 W	31K15GN-AW2J	31K15GN-AW2	CH55FAUL2
	31K15GN-AW2U		CH45FAUL2
	31K15GN-CW2J	31K15GN-CW2	CH15BFAUL
	31K15GN-CW2E		CH10BFAUL
25 W	41K25GN-AW2J	41K25GN-AW2	CH80CFAUL2
	41K25GN-AW2U		CH65CFAUL2
	41K25GN-CW2J	41K25GN-CW2	CH20BFAUL
	41K25GN-CW2E		CH15BFAUL
40 W	51K40GN-AW2J	51K40GN-AW2	CH110CFAUL2
	51K40GN-AW2U		CH90CFAUL2
	51K40GN-CW2J	51K40GN-CW2	CH30BFAUL
	51K40GN-CW2E		CH23BFAUL
60 W	51K60GE-AW2J	51K60GE-AW2	CH200CFAUL2
	51K60GE-AW2U		CH180CFAUL2
	51K60GE-CW2J	51K60GE-CW2	CH50BFAUL
	51K60GE-CW2E		CH40BFAUL
90 W	51K90GE-AW2J	51K90GE-AW2	CH280CFAUL2
	51K90GE-AW2U		CH200CFAUL2
	51K90GE-CW2J	51K90GE-CW2	CH70BFAUL
	51K90GE-CW2E		CH60BFAUL

Single-phase, 2-pole, high-speed type (Connection diagram: ②)

Models listed in the table below are the round shaft type motors.

Output power	Model	Motor model	Capacitor model
40 W	41K40A-BW2J	41K40A-BW2	CH90CFAUL2
	41K40A-BW2U		CH75CFAUL2
	41K40A-DW2J	41K40A-DW2	CH23BFAUL
	41K40A-DW3E		CH18BFAUL
60 W	41K60A-BW2J	41K60A-BW2	CH140CFAUL2
	41K60A-BW2U		CH100CFAUL2
	41K60A-DW2J	41K60A-DW2	CH30BFAUL
	41K60A-DW3E		CH25BFAUL
	51K60A-BW2J	51K60A-BW2	CH160CFAUL2
	51K60A-BW2U		CH140CFAUL2
	51K60A-DW2J	51K60A-DW2	CH40BFAUL
51K60A-DW3E	CH30BFAUL		
90 W	51K90A-BW2J	51K90A-BW2	CH280CFAUL2
	51K90A-BW2U		CH250CFAUL2
	51K90A-DW2J	51K90A-DW2	CH70BFAUL
	51K90A-DW3E		CH60BFAUL

Output power	Model	Motor model	Capacitor model
150 W	51K150A-BW2J	51K150A-BW2	CH400CFAUL2
	51K150A-BW2U		CH300CFAUL2
	51K150A-DW2J	51K150A-DW2	CH100BFAUL
	51K150A-DW3E		CH80BFAUL

Three-phase type (Connection diagram: ③)

Output power	Model	Motor model
6 W	21K6GN-SW2	21K6GN-SW2
15 W	31K15GN-SW2	31K15GN-SW2
25 W	41K25GN-SW2	41K25GN-SW2
40 W	51K40GN-SW2	51K40GN-SW2
60 W	51K60GE-SW2	51K60GE-SW2
90 W	51K90GE-SW2	51K90GE-SW2

Three-phase, 2-pole, high-speed type (Connection diagram: ③)

Models listed in the table below are the round shaft type motors.

Output power	Model	Motor model
60 W	51K60A-TW2	51K60A-TW2
90 W	51K90A-TW2	51K90A-TW2
150 W	51K150A-TW2	51K150A-TW2

● Reversible motors

Single-phase type (Connection diagram: ④)

Output power	Model	Motor model	Capacitor model
1 W	0RK1GN-AW2J	0RK1GN-AW2	CH18FAUL
	0RK1GN-AW3U	0RK1GN-AW3	CH12FAUL
	0RK1GN-CW2J	0RK1GN-CW2	CH045BFAUL
6 W	2RK6GN-AW2J	2RK6GN-AW2	CH45FAUL2
	2RK6GN-AW2U		CH35FAUL2
	2RK6GN-CW2J	2RK6GN-CW2	CH10BFAUL
	2RK6GN-CW2E		CH08BFAUL
15 W	3RK15GN-AW2J	3RK15GN-AW2	CH75CFAUL2
	3RK15GN-AW2U		CH60CFAUL2
	3RK15GN-CW2J	3RK15GN-CW2	CH18BFAUL
	3RK15GN-CW2E		CH15BFAUL
25 W	4RK25GN-AW2J	4RK25GN-AW2	CH100CFAUL2
	4RK25GN-AW2U		CH80CFAUL2
	4RK25GN-CW2J	4RK25GN-CW2	CH30BFAUL
	4RK25GN-CW2E		CH25BFAUL
40 W	5RK40GN-AW2J	5RK40GN-AW2	CH160CFAUL2
	5RK40GN-AW2U		CH120CFAUL2
	5RK40GN-CW2J	5RK40GN-CW2	CH40BFAUL
	5RK40GN-CW2E		CH35BFAUL
60 W	5RK60GE-AW2J	5RK60GE-AW2	CH250CFAUL2
	5RK60GE-AW2U		CH200CFAUL2
	5RK60GE-CW2J	5RK60GE-CW2	CH60BFAUL
	5RK60GE-CW2E		CH50BFAUL
90 W	5RK90GE-AW2J	5RK90GE-AW2	CH350CFAUL2
	5RK90GE-AW2U		CH300CFAUL2
	5RK90GE-CW2J	5RK90GE-CW2	CH80BFAUL
	5RK90GE-CW3E		CH70BFAUL

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)
100 V/200 V (Excluding the 1 W and 3 W types) : -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

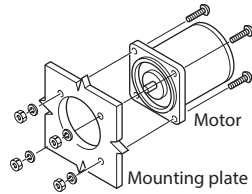
- Area free of excessive salt
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- 1000 m (3300 ft.) or less above sea level

■ 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.

First number of motor model	Nominal diameter of screw	Tightening torque [N·m (lb-in)]
0	M3	1.0 (8.8)
2	M4	2.0 (17.7)
3	M5	2.5 (22)
4		
5	M6	3.0 (26)

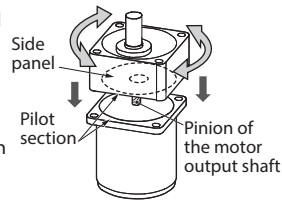


Note Do not insert the motor into the mounting hole at an angle or force it in, as this may scratch the flange pilot section and damage the motor.

● Pinion shaft type

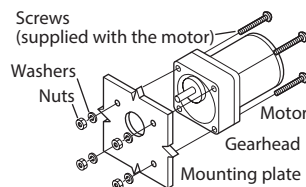
Assembling

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



Installing

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



Note

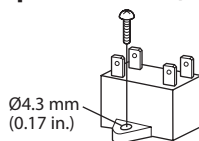
- Use the gearhead with pinion shaft which is identical with one of motor.
- Do not forcibly assemble the motor and gearhead. Also, prevent metal objects or foreign substances from entering in the gearhead. The pinion of the motor output shaft or gear may be damaged, resulting in noise or shorter service life.

● Motor with cooling fan

When installing a motor with cooling fan onto a device, leave 10 mm (0.39 in.) or more behind the fan cover or open a ventilation hole so that the cooling inlet on the back of the motor cover is not blocked.

■ 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).



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

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. Refer to the Oriental Motor Website for details.

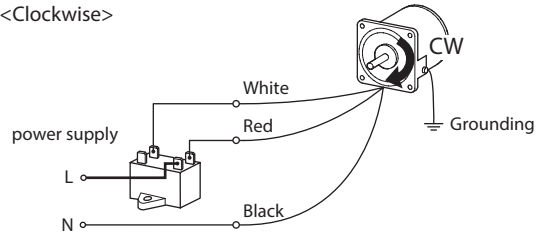
■ Connection diagram

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. Colors shown in the connection diagram indicate the colors of lead wires.

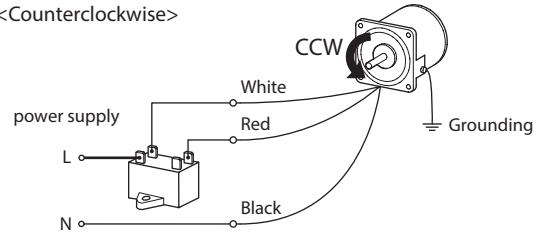
● Induction motors

Single-phase type (Connection diagram: ①)

<Clockwise>

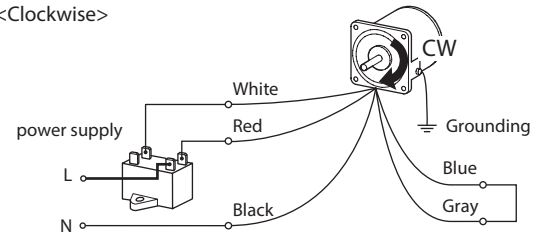


<Counterclockwise>

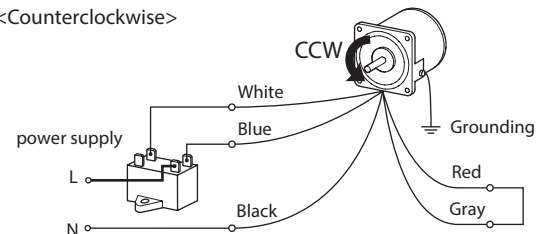


Single-phase, 2-pole, high-speed type (Connection diagram: ②)

<Clockwise>

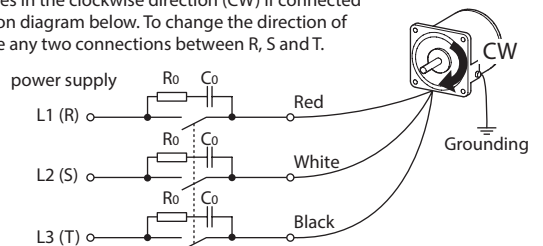


<Counterclockwise>



Three-phase type (Connection diagram: ③)

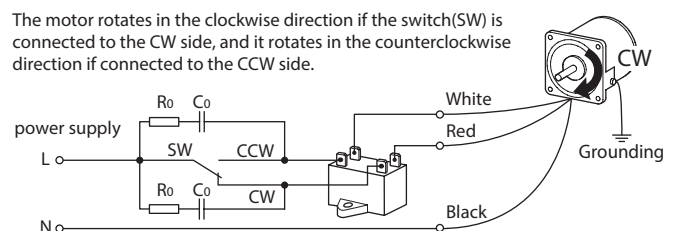
The motor rotates in the clockwise direction (CW) if connected as the connection diagram below. To change the direction of rotation, change any two connections between R, S and T.



● Reversible motors

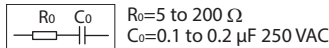
Single-phase type (Connection diagram: ④)

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

For power supply, use a thicker lead wire than the motor lead wire.

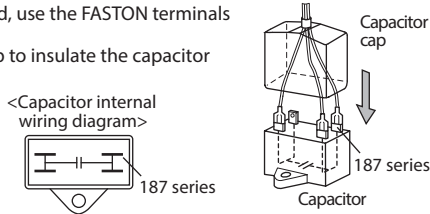
Motors of 1 W and 3 W: AWG24 (0.2 mm²)

Motors of 6W or larger: AWG20 (0.5 mm²)

■ 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.



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 (⊕).

Applicable crimp terminal:

Insulated round crimp terminal

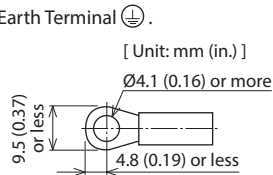
Terminal screw size: M4

Tightening torque:

1.0 to 1.3 N·m (8.8 to 11.5 lb-in)

Applicable minimum lead wire size:

AWG18 (0.75 mm²) or thicker



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

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.

Locked rotor burnout protection

This motor is equipped with one of the two features 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:

Power is turned off at 130±5 °C (266±9 °F)

Power is turned back on at 82±15 °C (180±27 °F)*

* 90±15 °C (194±27 °F) for **3IK15GN-SW2**, **3IK15A-SW2**

■ 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"> Check the power supply voltage. Connect the power supply and the motor correctly. With a single-phase motor, connect the supplied capacitor correctly. If terminal blocks or crimp terminals are used, check them for poor connection. Keep the load at or below the allowable value.
Motor sometimes rotates and stops.	<ul style="list-style-type: none"> Connect the power supply and the motor correctly. With a single-phase motor, connect the supplied capacitor correctly. If terminal blocks or crimp terminals are used, check them for poor connection.
The motor rotates in the direction opposite to the specified direction.	<ul style="list-style-type: none"> Connect correctly by referring to "Connection diagram." With a single-phase motor, connect the supplied capacitor correctly. 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 the Oriental Motor Website for details. The rotating direction is indicated as viewed from the motor output shaft. Check the reference direction.
Motor temperature abnormally high [Motor case temperature exceeds 90 °C (194 °F)]	<ul style="list-style-type: none"> Check the power supply voltage. With a single-phase motor, connect the supplied capacitor correctly. Review the ventilation condition.
Noisy operation	<ul style="list-style-type: none"> Assemble the motor and gearhead correctly. Assemble a gearhead of the same pinion type as the motor.

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