

## Speed Control Motor and Control Unit Package

# US Series

- 110 V/115 V type
- 220 V/230 V type

---

## OPERATING MANUAL

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.




### Table of Contents

1	Precautions .....	2	5	Operation .....	11
2	Checking the package contents .....	4	5.1	Starting, Changing speeds, Stopping .....	11
2.1	Checking the contents .....	4	5.2	Operating the motor in one direction .....	12
2.2	Regulations and standards .....	4	5.3	Switching between rotation directions .....	12
2.3	Checking the product name and motor-control unit combination .....	5	5.4	Extension cables .....	13
2.4	Information about nameplate .....	5	6	Characteristics .....	14
3	Installation .....	6	7	Locked rotor burnout protection of motor .....	15
3.1	Installation conditions .....	6	8	Troubleshooting .....	16
3.2	Mounting the motor .....	6	9	Maintenance and inspection .....	17
3.3	Installing the control unit .....	7	9.1	Inspection .....	17
3.4	Installing the capacitor (when using a motor with a capacitor) .....	8	9.2	Warranty .....	17
3.5	Conformity to the EMC .....	8	9.3	Disposal .....	17
4	Connection .....	10	10	Specifications .....	18
			10.1	Specifications .....	18
			10.2	General specifications .....	18

# 1 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.

 <b>WARNING</b>	
	<ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> <li>• Do not forcibly bend, pull or pinch the cable. Doing so may fire and electric shock.</li> <li>• Do not remove the covers attached to the 60 W and 90 W type capacitors. Doing so may result in electric shock.</li> <li>• Do not touch the connection terminals of the control unit and capacitor immediately after the power is turned off (for a period of 10 seconds). The residual voltage may cause electric shock.</li> <li>• Do not disassemble or modify the motor or control unit. This may cause electric shock or injury. Refer all such internal inspections and repairs to the branch or sales office from which you purchased the product.</li> </ul>
	<ul style="list-style-type: none"> <li>• Only qualified and educated personnel should be allowed to perform installation, connection, operation and inspection/troubleshooting of the product. Handling by unqualified and uneducated personnel may result in fire, electric shock, injury or damage to equipment.</li> <li>• 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 fan will start abruptly when the overheat protection device (thermal protector) is automatically reset.</li> <li>• The motor is Class I equipment. Install the motor and control unit so as to avoid contact with hands, or ground it to prevent the risk of electric shock.</li> <li>• Install the motor in an enclosure in order to prevent electric shock or injury.</li> <li>• Keep the control unit's input-power voltage within the specification to avoid fire and electric shock.</li> <li>• Connect the cables securely according to the wiring diagram in order to prevent fire and electric shock.</li> <li>• To prevent electric shock, be sure to install the terminal cover over the control unit's terminals after making connections.</li> <li>• Connect an earth leakage breaker to the power line of the control unit to protect the primary circuit. Failure to do so may result in fire.</li> <li>• Turn off the control unit power in the event of a power failure, or the motor may suddenly start when the power is restored and may cause injury or damage to equipment.</li> </ul>



## CAUTION

	<ul style="list-style-type: none"> <li>• Do not use the motor and control unit beyond their specifications, or electric shock, injury or damage to equipment may result.</li> <li>• Keep your fingers and objects out of the openings in the motor, or electric shock, injury or damage to equipment may result.</li> <li>• Do not touch the motor during operation or immediately after stopping. The surface is hot and may cause a skin burn(s).</li> <li>• Do not hold the motor output shaft or motor cable. This may cause injury.</li> <li>• Keep the area around the motor and control unit free of combustible materials in order to prevent fire or a skin burn(s).</li> <li>• To prevent the risk of damage to equipment, leave nothing around the motor and control unit that would obstruct ventilation.</li> <li>• To prevent bodily injury, do not touch the rotating parts (output shaft and cooling fan) of the motor during operation.</li> </ul>
	<ul style="list-style-type: none"> <li>• The motor should be firmly secured on the metallic plate in order to prevent injury and damage to the equipment.</li> <li>• Provide a cover over the rotating parts (output shaft) of the motor to prevent injury.</li> <li>• Install a ground-leakage breaker. Failure to do so may result in fire.</li> <li>• Use a motor and control unit only in the specified combination. An incorrect combination may cause a fire.</li> <li>• 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.</li> <li>• Immediately when trouble has occurred, stop running and turn off the control unit power. Failure to do so may result in fire, electric shock or injury.</li> <li>• Before turning on the power to the control unit, set the RUN/STAND-BY switch to STAND-BY and the speed potentiometer to LOW.</li> <li>• 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).</li> </ul> <div style="text-align: right;">   Warning label </div>

## 2 Checking the package contents

### 2.1 Checking the contents

Make sure that you have received all of the items listed below.

If an accessory is missing or damaged, contact the nearest ORIENTAL MOTOR office.

- Motor .....1 unit
- Control unit.....1 unit
- Capacitor.....1 piece (Only for 60 W and 90 W type)\*
- Control unit mounting screw (M3).....1 set  
(Screws, spring washers, nuts 4 pieces each)
- Instructions and Precautions for Safe Use .....1 copy

\* A capacitor is connected to the control unit at the time of shipment.

### 2.2 Regulations and standards

#### ■ UL Standards, CSA Standards

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

#### ■ CE Marking

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

##### • Low Voltage Directive

##### Installation conditions

Motor	Control unit
Overvoltage category: II	Overvoltage category: II
Pollution degree: 2	Pollution degree: 2
Degree of protection: IP20	Degree of protection: IP10
Protection against electric shock: Class I	Protection against electric shock: Class I

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

- This product cannot be used in IT power distribution systems.

Since the control unit is not equipped with a ground fault protection circuit, consider the following.

- Earth leakage breaker: Conforming to EN or IEC Standards  
Conditional short-circuit current rating Icc: 5 kA  
Rated sensitivity current: 30 mA or less

##### • EMC Directive

Refer to "3.5 Conformity to the EMC" on page 8 for details about conformity.

#### ■ RoHS Directive

This products do not contain the substances exceeding the restriction values.

#### ■ CCC System

The motors are affixed with the CCC Marking under the China Compulsory Certification System. It is also certified by CQC.

## 2.3 Checking the product name and motor-control unit combination

This product comes in a combined set consisting of a motor and a control unit. When the product first arrives, check the nameplates to confirm that you have received the correct motor and control unit combination.

- Model name is not the recognized name under the various safety standards.  
Recognized name is motor model name and control unit name.
- The gear ratio appears at the position in the model number indicated by the box (□).

### ■ 110 V/115 V type

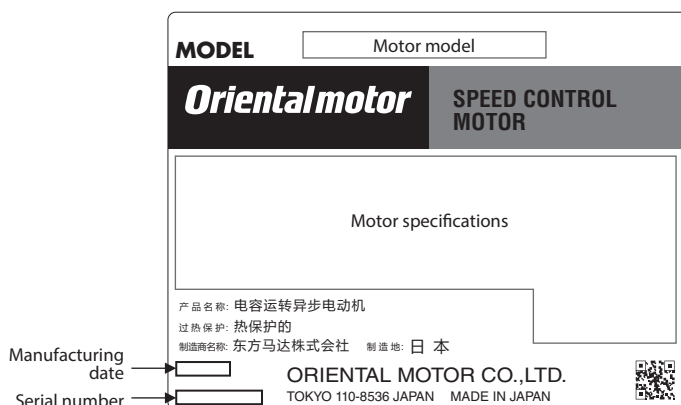
Model	Motor model	Control unit model	Capacitor type	Compatible gearhead model (sold separately)
US206-401U2	USM206-401W2	USP206-1U2	Internal	2GN□S, 2GN□K
US206-001U2	USM206-001W2			-
US315-401U2	USM315-401W2	USP315-1U2		3GN□S, 3GN□K
US315-001U2	USM315-001W2			-
US425-401U2	USM425-401W2	USP425-1U2		4GN□S, 4GN□K, 4GN□RH, 4GN□RA
US425-001U2	USM425-001W2			-
US540-401U2	USM540-401W2	USP540-1U2		5GN□S, 5GN□K, 5GN□RH, 5GN□RA
US540-001U2	USM540-001W2			-
US560-501U2	USM560-501W-1	USP560-1U2	External	5GU□KB, 5GU□RH, 5GU□RA
US560-001U2	USM560-001W-1			-
US590-501U2	USM590-501W-1	USP590-1U2		5GU□KB, 5GU□KBH, 5GU□RH, 5GU□RA
US590-001U2	USM590-001W-1			-

### ■ 220 V/230 V type

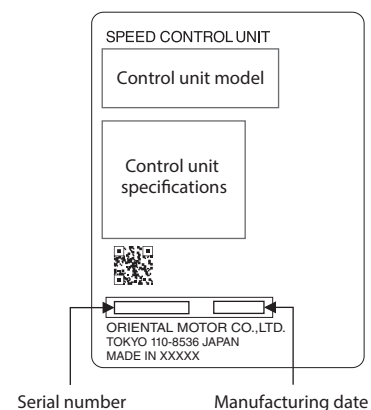
Model	Motor model	Control unit model	Capacitor type	Compatible gearhead model (sold separately)
US206-402E2	USM206-402W2	USP206-2E2	Internal	2GN□S, 2GN□K
US206-002E2	USM206-002W2			-
US315-402E2	USM315-402W2	USP315-2E2		3GN□S, 3GN□K
US315-002E2	USM315-002W2			-
US425-402E2	USM425-402W2	USP425-2E2		4GN□S, 4GN□K, 4GN□RH, 4GN□RA
US425-002E2	USM425-002W2			-
US540-402E2	USM540-402W2	USP540-2E2		5GN□S, 5GN□K, 5GN□RH, 5GN□RA
US540-002E2	USM540-002W2			-
US560-502E2	USM560-502W-1	USP560-2E2	External	5GU□KB, 5GU□RH, 5GU□RA
US560-002E2	USM560-002W-1			-
US590-502E2	USM590-502W-1	USP590-2E2		5GU□KB, 5GU□KBH, 5GU□RH, 5GU□RA
US590-002E2	USM590-002W-1			-

## 2.4 Information about nameplate

### • Motor



### • Control unit



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

## 3 Installation

### 3.1 Installation conditions

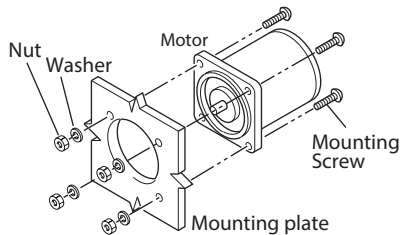
Install the motor and control unit in a location that meets the following conditions. Using the unit in a location that does not satisfy these conditions could damage it.

- Indoors (this product is designed and manufactured to be installed within another device)
- Ambient temperature Motor:  $-10$  to  $+40$  °C ( $+14$  to  $+104$  °F) (non-freezing)  
Control unit:  $0$  to  $+40$  °C ( $+32$  to  $+104$  °F) (non-freezing)
- Ambient humidity: 85% max. (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
- A place where heat can escape easily
- Area not subject to continuous vibration or excessive shocks
- 1000 m or less above sea level

### 3.2 Mounting the motor

#### ■ Round shaft motors

1. Drill holes in the mounting plate that match the screws and the motor's dimensions.
2. Use screws, washers, and nuts listed below to fasten the motor to the mounting plate. Make sure that no gaps are left between the motor and the surface of the mounting plate.  
Use screws of an appropriate length.



#### Mounting screws

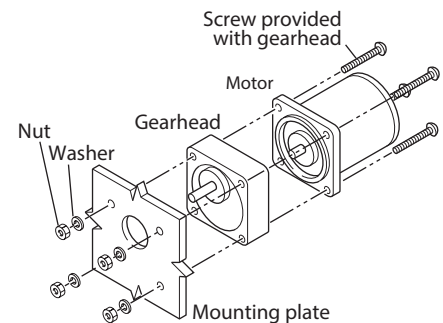
Motor frame size [mm (in.)]	Screw size	Tightening torque [N·m (lb-in)]
□60 (□2.36)	M4	2.0 (17.7)
□70 (□2.76)	M5	2.5 (22)
□80 (□3.15)	M5	2.5 (22)
□90 (□3.54)	M6	3.0 (26)



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

#### ■ Pinion shaft motor

1. Drill holes in the mounting plate that match the screws and the gearhead's dimensions.
2. Attach the motor and gearhead using the screws supplied with the gearhead (sold separately). Attach by using the pilot section as a guide and rotating the gearhead gently left and right, being careful that the shaft's gear pinion section does not strike the gearhead side plate (metal plate) or gears strongly.
3. Fasten the screws supplied with the gearhead to the mounting plate. Attach so that no gaps are left between the motor flange surface and the gearhead pilot section end surface.



Refer to the gearhead operation manual for further details concerning mounting (gearhead sold separately).

Mounting bracket is available as an option (sold separately).

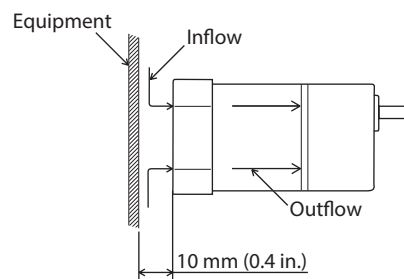


- Confirm gearhead compatibility by checking the table in section "2.3 Checking the product name and motor-control unit combination" on page 5.
- Keep the motor and gearhead's pilot section free of dirt, as the presence of dirt can result in inadequate fastening and cause grease to leak from the gearhead.
- Scratches and dents on the gears can cause unusual sounds.

### ■ Motor with cooling fan

When mounting a motor with a cooling fan onto a device, open a ventilation hole or leave 10 mm (0.4 in.) or more behind the fan cover so that the cooling inlet on the back of the motor cover is not blocked.

The cooling fan does not always operate while the motor is running. It operates depending the input voltage supplied to the motor.



## 3.3 Installing the control unit

There are two methods for mounting the control unit onto a machine.

Refer to the mounting methods described below.

M4 screws are not included with the control unit. Users must supply these screws on their own.

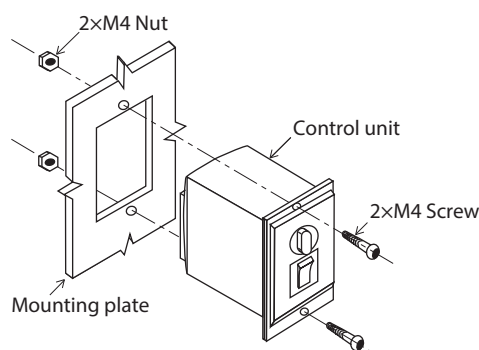
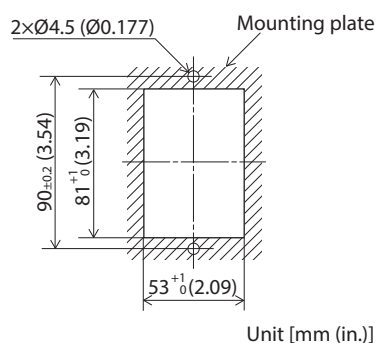


Use a tightening torque of 0.7 N·m (6.1 lb-in) or less for the screws.

Tightening them at a torque above 0.7 N·m (6.1 lb-in) could damage the control unit.

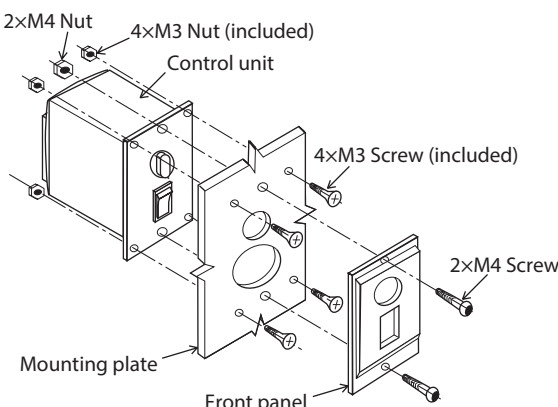
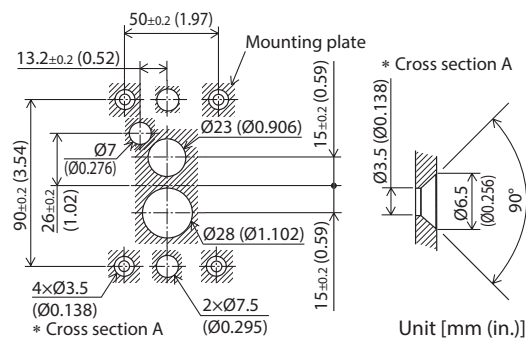
### ■ Installing by opening a square hole

1. Cut a hole in the mounting plate as indicated in the diagram to the left.
2. Insert the control unit from the front of the mounting plate and fasten with screws and nuts (M4: 2 pcs. of each).



### ■ Installing without opening a square hole

1. Cut holes in the mounting plate as indicated in the diagram to the left.
2. Remove the front panel from the control unit. (Grasp the front panel alone and pull forward to remove.)
3. Fasten the control unit to the mounting plate using the 4 M3 screws and nuts included.
4. Fasten the front panel onto the front of the mounting plate using the screws and nuts (M4: 2 pcs. of each).



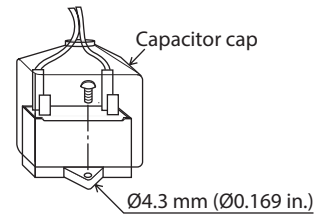
Use a plate 2 mm (0.08 in.) or less in thickness when the mounting plate sandwiched between the control unit and the front panel.

### 3.4 Installing the capacitor (when using a motor with a capacitor)

Use M4 screws to mount the capacitor (screws not included).



- Do not remove the capacitor cap from the capacitor.
- Do not let the screw fastening torque exceed 1 N·m (8.8 lb-in) to prevent damage to the mounting feet.
- 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 reduced. The lead wire (yellow) for capacitor should be about 30 cm (11.81 in.) long.



### 3.5 Conformity to the EMC

Effective measures must be taken against the EMI that the motor and control unit may give to adjacent control system equipment, as well as the EMS of the motor and control unit itself, in order to prevent a serious functional impediment in the machinery. The use of the following installation and wiring methods will enable the motor and control unit to be compliant with the EMC.

Oriental Motor conducts EMC testing on its motors and control unit in accordance with "Example of installation and wiring" on page 9. The user is responsible for ensuring the machine's compliance with the EMC, based on the installation and wiring explained below.



## CAUTION

This equipment is not intended for use in residential environments nor for use on a low-voltage public network supplied in residential premises, and it may not provide adequate protection to radio reception interference in such environments.

#### ■ Connecting mains filter

Install a mains filter in the power supply line in order to prevent the noise generated within the control unit from propagating outside via the power supply line.

For mains filters, the products are shown in the below chart, or an equivalent.

Manufacturer	Model
SOSHIN ELECTRIC CO.,LTD	NF2010A-UP
Schaffner EMC	FN2070-10-06

Install the mains filter as close to the AC input terminal as possible, and use cable clamps and other means to secure the input and output cables firmly to the surface of the enclosure. Connect the ground terminal of the mains filter to the grounding point, using as thick and short a wire as possible.

Do not place the AC input cable (AWG18: 0.75 mm<sup>2</sup> or more) parallel with the mains-filter output cable (AWG18: 0.75 mm<sup>2</sup> or more). Parallel placement will reduce mains-filter effectiveness if the enclosure's internal noise is directly coupled to the power supply cable by means of stray capacitance.

#### ■ Grounding procedure

The cable used to ground the motor must be as thick and short to the grounding point as possible so that no potential difference is generated. Choose a large, thick and uniformly conductive surface for the grounding point.

##### • How to ground the control unit

Ground the ground terminal of the control unit.

##### • How to ground the motor

When installing the motor, ground the motor using a protective earth terminal. For the motor is not equipped with protective earth terminals, scrape the paint away from the mounting flange and connect the grounding cable along with a set screw to the grounding point, using an inner-clip washer.

#### ■ Motor cable connection

When the motor cable is extended, use the optional extension cables (sold separately).

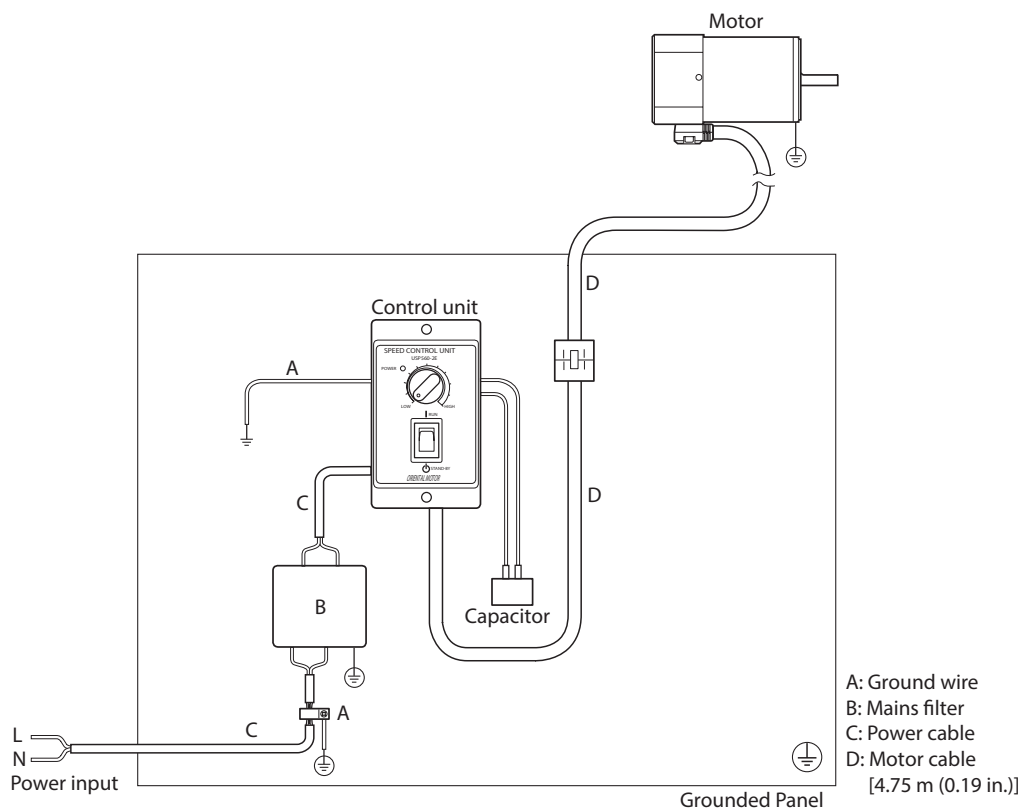
Refer to the table of "5.4 Extension cables" on page 13.

#### ■ Notes about installation and wiring

- Connect the motor and other peripheral control equipment directly to the grounding point so as to prevent a potential difference from developing between grounds.
- When relays or electromagnetic switches are used together with the system, use mains filters and CR circuits to suppress surges generated by them.



## ■ Example of installation and wiring



## ■ Precautions about static electricity

Static electricity may cause the control unit to malfunction or become damaged. Be careful when handling the control unit with the power on.

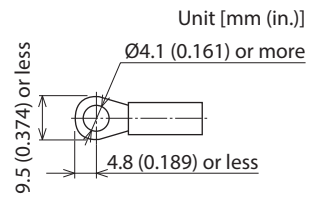
**Note** Do not come close to or touch the control unit while the power is on.

# 4 Connection

## ■ Connection steps

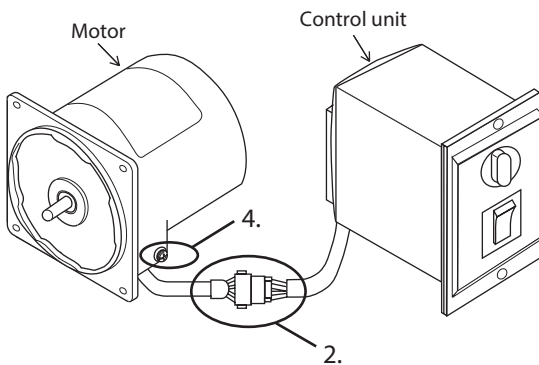
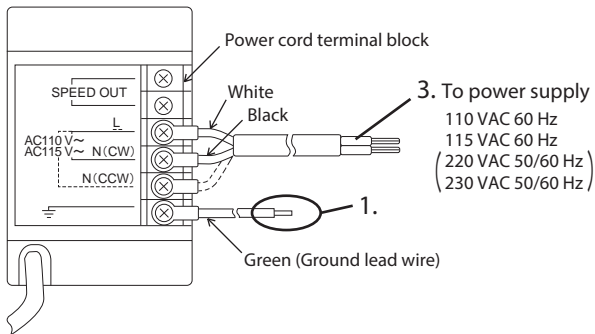
Below is an explanation of how to use the unit as it was set up at the factory.  
 The motor's direction of rotation is set in a clockwise direction viewing the motor from the side with the output shaft.  
 When changing the motor's direction, refer to section "5 Operation" on page 11.  
 Control unit in illustration is the 110 V/115 V type, with internal capacitor.

1. Ground the green ground wire to ground. The function of this ground is for eliminating noise.
2. Connect the motor connector to the control unit connector. Make sure the connection is secure by inserting the connectors until you hear the sound of them coupling.
3. Connect the power cord to the power supply after confirming that the control unit's "RUN/STAND-BY" switch is set to "STAND-BY", and that the speed potentiometer's knob is set to "LOW". The control unit's green power light goes on when the power is turned on.
4. Ground the motor using the motor's protective earth terminal  $\oplus$ .  
 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 more



\* For 60 W and 90 W type, the motor is not equipped with protective earth terminals. Refer to "Grounding procedure" on page 8.

Control unit rear panel



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

## ■ Connecting the earth leakage breaker

Connect an earth leakage breaker to the power line of the control unit to protect the primary circuit.

(⇒ Refer to p.4)

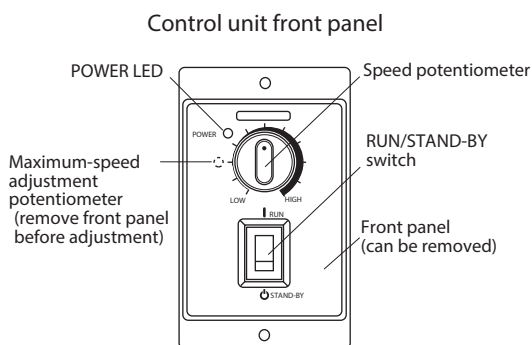
Recommended device: Mitsubishi Electric Corporation NV series

# 5 Operation

## Note

- Make sure that the motor case temperature does not exceed 90 °C (194 °F) during motor operation. Operating the motor above 90 °C (194 °F) will shorten the life of the coil and the ball bearings. Motor case temperature can be measured by fastening a thermometer to the motor's surface, or with thermo-tape. Thermal Class: 130 (B)
- When operating the motor of 60 W and 90 W type at the low speed with light load, the cooling fan on the back of the motor will not rotate because the heating of the motor is low.
- A filter for external noise is built into the control unit. However variations from the desired speed may occur depending on the noise level. Test your control unit after installing. Faulty operation can be prevented by installing a noise filter and ferrite core.
- Only after turning the power OFF can the lead wires of the power cord terminal block be changed.

## 5.1 Starting, Changing speeds, Stopping



## Note

The "RUN/STAND-BY" switch does not turn the power on and off. Install a separate power switch for situations where the motor is to be stopped for extended periods of time.

### ■ Starting

Flip the control unit's "RUN/STAND-BY" switch to the "RUN" position. The motor will begin rotating at the speed set with the rotation speed potentiometer.

### ■ Stopping

Flip the control unit's "RUN/STAND-BY" switch to the "STAND-BY" position to stop the motor.

### ■ Changing speeds

Turning the rotation speed potentiometer's knob clockwise (toward HIGH) makes the motor go faster, turning it counterclockwise (toward LOW) makes the motor go slower. The motor can be set to rotate at a speed of between 90 to 1400 r/min (50 Hz) or 90 to 1600 r/min (60 Hz).

The set speed does not change in the range of 90 to 1400 r/min, even when the power supply frequency changes.

\* The speed may exceed the upper limit of the variable-speed range before the speed potentiometer is turned to the maximum level (HIGH side).

When the maximum-speed adjustment potentiometer is used, the entire range of the speed potentiometer can be used.

### How to adjust maximum speed

Remove the front panel and adjust the maximum speed according to the following procedure:

1. Set the "RUN/STAND-BY" switch to "RUN".
2. Turn the speed potentiometer to the maximum level.
3. Turn the maximum-speed adjustment potentiometer until 1400 r/min (50 Hz) or 1600 r/min (60 Hz) is reached. Turning the potentiometer counterclockwise increases the maximum speed, while turning it clockwise decreases the speed. Use an insulated precision Phillips screwdriver for the adjustment.

## Note

When the maximum-speed adjustment potentiometer was used to adjust the maximum speed, readjustment will be necessary if the power supply frequency has been changed.

## 5.2 Operating the motor in one direction

Connections differ depending on the type of capacitor, internal or external.

To identify the capacitor type, refer to the table in section "2.3 Checking the product name and motor-control unit combination" on page 5.

The motor rotates in a clockwise (CW) and counterclockwise (CCW) direction (viewing the motor from the side with the output shaft).

Because the motor's direction of rotation is set in a clockwise direction when shipping, the lead wires of the power cord terminal block are connected to N (CW).

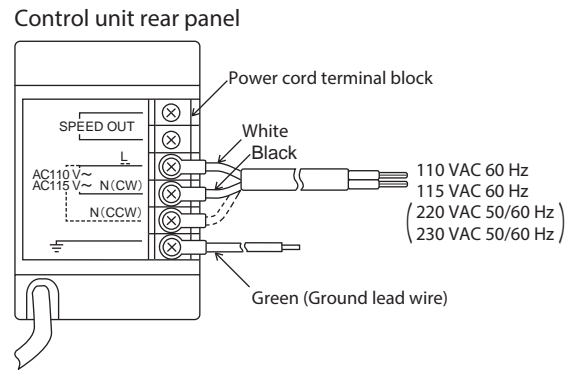
When operating the motor in a counterclockwise direction, connect the lead wires to N (CCW).

Control unit in illustration is the 110 V/115 V type.

### Changing the motor's rotation direction "CW" (set at the factory) to "CCW"

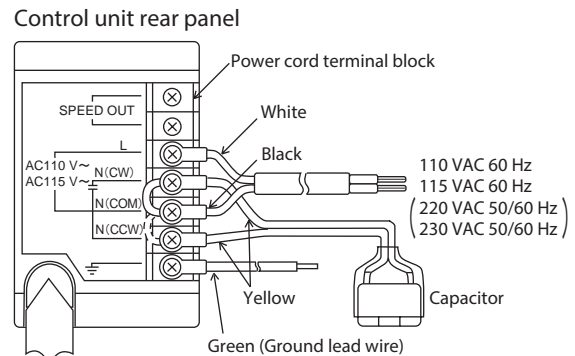
#### ■ Motor with internal capacitor

1. Remove the plastic cover over the power cord terminal block on the rear of the control unit.
2. Disconnect the black lead wire connected to the power cord terminal from N (CW) and reconnect it to N (CCW). When the control unit is shipped from the factory, lead wires are connected to power cord terminals L and N (CW).
3. Replace the plastic cover over the power cord terminal block.



#### ■ Motor with external capacitor

1. Remove the plastic cover over the power cord terminal block on the rear of the control unit.
2. Disconnect the black lead wire connected to the power cord terminal from N (CW) and reconnect it to N (CCW). Do not change the capacitor's lead wire (the yellow wire). When the control unit is shipped from the factory, the black lead wire connected to the power cord terminal is connected to N (COM) and N (CW).
3. Replace the plastic cover over the power cord terminal block.



## 5.3 Switching between rotation directions

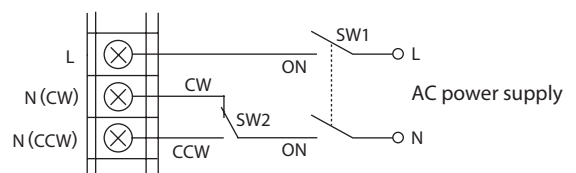
Users must provide a power switch and a forward/reverse switch.



Change the motor's direction of rotation only after the motor has come to a complete stop. If you try to change direction before it has stopped, you may be unsuccessful or it may take extra time.

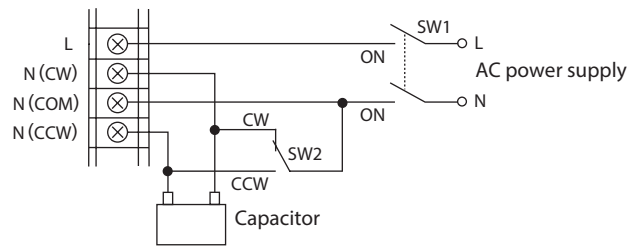
#### ■ Motor with internal capacitor

1. Connect a power switch "SW1" and a forward/reverse switch "SW2".
2. Flip the "RUN/STAND-BY" switch to "STAND-BY" and make sure that the motor comes to a complete stop.
3. After the motor stops, turn off the power switch "SW1" and turn "SW2" to CW/CCW.
4. Flip the power switch "SW1" to ON.



■ **Motor with external capacitor**

1. Disconnect the black lead wire connected to N (COM) and N (CW) of the power cord terminal block.
2. Connect a power switch "SW1" and a forward/reverse switch "SW2".
3. Flip the "RUN/STAND-BY" switch to "STAND-BY" and make sure that the motor comes to a complete stop.
4. After the motor stops, turn off the power switch "SW1" and turn "SW2" to CW/CCW.
5. Flip the power switch "SW1" to ON.



■ **Contact capacity of the switch**

Use the switch of 250 VAC, 5 A or more capacity.

**5.4 Extension cables**

The distance between the motor and control unit is 0.75 m (3 in.) normally, use an extension cable (sold separately) in situations where the motor and control unit are to be used apart from each other. Using the longest cable, the distance can be extended up to 4.75 m (190 in.).

■ **US206, US315, US425 and US540 types**

Model	Cable length [m (in.)]
CC01SU05	1 (39.37)
CC02SU05	2 (78.74)
CC03SU05	3 (118.11)
CC04SU05	4 (157.48)

■ **US560, US590 types**

Model	Cable length [m (in.)]
CC01SU07	1 (39.37)
CC02SU07	2 (78.74)
CC03SU07	3 (118.11)
CC04SU07	4 (157.48)



Do not use multiple extension cables connected to each other, as this could result in faulty operation.

# 6 Characteristics

## ■ Safe-operation line

Input power to the speed control motor varies with the load and the speed. The greater the load, and the lower the speed, the higher the motor's temperature will rise.

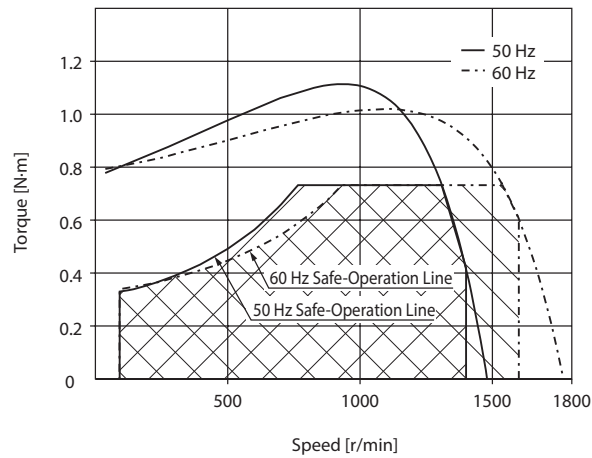
The graph left displays the relationship between the speed and the torque characteristics of the AC speed control motor. The line is referred to as the safe-operation line and the shaded area is called the continuous operation area.

The safe-operation line, measured by motor's temperature, indicates its operational limit for continuous usage with the temperature level below the permissible maximum.

Whether the motor can be operated continuously or not is judged by measuring the temperature of the motor case.

When the temperature of the case is below 90 °C (194 °F), the motor is capable of continuous operation.

When using a gearhead, be aware that it is necessary to operate below the maximum permissible torque. If the actual torque required should exceed the maximum permissible torque, it may cause possible damage to the motor and/or shorten its life.



# 7 Locked rotor burnout protection of motor

## WARNING

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 fan will start abruptly when the overheat protection device (thermal protector) is automatically reset.

This motor is equipped with the function to prevent the motor from burning out as a result of abnormal heating caused by some reasons, which protects the motor in two ways.

### ■ Thermal protection (“TP” is stamped on the motor nameplate)

When the motor reaches a predetermined temperature, the internal thermal protector is activated and the motor is stopped.

With the automatic resume feature, the motor automatically begins operating again as soon as the motor temperature falls.

Always turn the power off before performing inspections.

Thermal protector activation range: Power is turned off at  $130\pm 5$  °C ( $266\pm 9$  °F)

Power is turned back on at  $85\pm 20$  °C ( $185\pm 36$  °F)

### ■ Impedance protection (“ZP” is stamped on the motor nameplate)

When the motor goes into locked rotor condition due to a malfunction, coil impedance rises, suppressing input to the motor and protecting the motor coil from burnout.

# 8 Troubleshooting

When the motor is not functioning normally, perform an inspection covering the points listed in the table below. If the inspection shows that everything is normal but the motor and control unit still are not functioning normally, contact the nearest ORIENTAL MOTOR office.

Problem	Things to check
The motor does not rotate	Is the correct voltage being supplied to the control unit?
	Have the motor and control unit become disconnected?
	Is the load too large?
	Is the control unit's "RUN/STAND-BY" switch set to "STAND-BY"?
	Do you have the right motor-control unit combination?
	Is the control unit's speed knob turned to LOW?
	Was the thermal protector activated?
	If you are using a motor with an external capacitor, is it connected as indicated in "4 Connection" or "5 Operation"?
The motor does not rotate in the wrong direction	Are the connections right? Check "4 Connection" or "5 Operation."
	The gearhead output shaft's rotation direction differs depending on the gearhead's deceleration ratio. Refer to catalogue for details.
	If you are using a motor with an external capacitor, is it connected as indicated in "4 Connection" or "5 Operation"?
	Are you looking at the motor from the wrong side? Rotation is defined as being clockwise and counterclockwise when viewing the motor from the side with the output shaft.
The motor becomes extraordinarily hot [motor case temperature exceeds 90 °C (194 °F)]	Is the correct voltage being supplied to the control unit?
	Does the ambient temperature exceed the permissible range?
	Do you have the right motor-control unit combination?
The power lamp does not go on	Is the power cord correctly connected to the power supply?
The motor makes a strange noise	Are the motor and gearhead correctly fastened? Refer to the gearhead operation manual.
	Is the coupled gearhead the same pinion type as the motor shaft?
The cooling fan does not rotate	Are you operating the motor at low speed without a load? If turning the speed potentiometer's knob to HIGH causes the cooling fan to begin rotating, it is operating normally.



# 9 Maintenance and inspection

---

## 9.1 Inspection

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



- Conduct the insulation resistance measurement or dielectric strength test separately on the motor and the control unit. Conducting the insulation resistance measurement or dielectric strength test with the motor and control unit connected may result in damage to the product.
- The control unit uses semiconductor components. So be extremely careful when handling them. Static electricity may damage the control unit.

### ■ Inspection item

- Check if any of the mounting screws for the motor and control unit 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 and a load shaft are out of alignment.
- Check if a damage or stress is applied on the cable, or the connection part between the motor and control unit is loose.
- Check if any of the power cord terminal screws of the control unit is loose.
- Check if the control unit has appearance defects or unusual smells.

## 9.2 Warranty

Check on the Oriental Motor Website for the product warranty.

## 9.3 Disposal

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

# 10 Specifications

## 10.1 Specifications

Check on the Oriental Motor Website for the product specifications.

## 10.2 General specifications

Operating environment	Ambient temperature	Motor: -10 to +40 °C [+14 to +104 °F] (non-freezing) Control unit: 0 to +50 °C [+32 to +122 °F] (non-freezing)
	Ambient humidity	85% or less (non-condensing)
	Altitude	Up to 1000 m (3300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil. Cannot be used in radioactive materials, magnetic field, vacuum or other special environments.
	Vibration	Not subject to continuous vibrations or excessive impact. In conformance with JIS C 60068-2-6 "Sine-wave vibration test method" Frequency range: 10 to 55 Hz Pulsating amplitude: 0.15 mm (0.006 in.) Sweep direction: 3 directions (X, Y, Z) Number of sweeps: 20 times
Storage environment	Ambient temperature	-25 to +70°C [-13 to +158°F] (non-freezing)
	Ambient humidity	85% or less (non-condensing)
Shipping environment	Altitude	Up to 3000 m (10000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil. Cannot be used in radioactive materials, magnetic field, vacuum or other special environment.
Degree of protection		Motor: IP20 (6 W to 40 W), IP40 (60 W, 90 W) Control unit: IP10



- Unauthorized reproduction or copying of all or part of this manual is prohibited.  
If a new copy is required to replace an original manual that has been damaged or lost, please contact your nearest Oriental Motor branch or sales office.
- Oriental Motor shall not be liable whatsoever for any problems relating to industrial property rights arising from use of any information, circuit, equipment or device provided or referenced in this manual.
- Characteristics, specifications and dimensions are subject to change without notice.
- While we make every effort to offer accurate information in the manual, we welcome your input. Should you find unclear descriptions, errors or omissions, please contact the nearest office.
- **Orientalmotor** is a registered trademark or trademark of Oriental Motor Co., Ltd., in Japan and other countries.  
Other product names and company names mentioned in this manual may be registered trademarks or trademarks of their respective companies and are hereby acknowledged. The third-party products mentioned in this manual are recommended products, and references to their names shall not be construed as any form of performance guarantee. Oriental Motor is not liable whatsoever for the performance of these third-party products.

© Copyright ORIENTAL MOTOR CO., LTD. 2008

Published in March 2023

- Please contact your nearest Oriental Motor office for further information.

ORIENTAL MOTOR U.S.A. CORP.  
Technical Support Tel:800-468-3982  
8:30am EST to 5:00pm PST (M-F)  
[www.orientalmotor.com](http://www.orientalmotor.com)

ORIENTAL MOTOR (EUROPA) GmbH  
Schiesstraße 44, 40549 Düsseldorf, Germany  
Technical Support Tel:00 800/22 55 66 22  
[www.orientalmotor.de](http://www.orientalmotor.de)

ORIENTAL MOTOR (UK) LTD.  
Unit 5 Faraday Office Park, Rankine Road,  
Basingstoke, Hampshire RG24 8QB UK  
Tel:+44-1256347090  
[www.oriental-motor.co.uk](http://www.oriental-motor.co.uk)

ORIENTAL MOTOR (FRANCE) SARL  
Tel:+33-1 47 86 97 50  
[www.orientalmotor.fr](http://www.orientalmotor.fr)

ORIENTAL MOTOR ITALIA s.r.l.  
Tel:+39-02-93906347  
[www.orientalmotor.it](http://www.orientalmotor.it)

ORIENTAL MOTOR ASIA PACIFIC PTE. LTD.  
Singapore  
Tel:1800-842-0280  
[www.orientalmotor.com.sg](http://www.orientalmotor.com.sg)

ORIENTAL MOTOR (MALAYSIA) SDN. BHD.  
Tel:1800-806-161  
[www.orientalmotor.com.my](http://www.orientalmotor.com.my)

ORIENTAL MOTOR (THAILAND) CO., LTD.  
Tel:1800-888-881  
[www.orientalmotor.co.th](http://www.orientalmotor.co.th)

ORIENTAL MOTOR (INDIA) PVT. LTD.  
Tel:1800-120-1995 (For English)  
1800-121-4149 (For Hindi)  
[www.orientalmotor.co.in](http://www.orientalmotor.co.in)

TAIWAN ORIENTAL MOTOR CO., LTD.  
Tel:0800-060708  
[www.orientalmotor.com.tw](http://www.orientalmotor.com.tw)

SHANGHAI ORIENTAL MOTOR CO., LTD.  
Tel:400-820-6516  
[www.orientalmotor.com.cn](http://www.orientalmotor.com.cn)

INA ORIENTAL MOTOR CO., LTD.  
Korea  
Tel:080-777-2042  
[www.inaom.co.kr](http://www.inaom.co.kr)

ORIENTAL MOTOR CO., LTD.  
4-8-1 Higashiueno, Taito-ku, Tokyo  
110-8536 Japan  
Tel:+81-3-6744-0361  
[www.orientalmotor.co.jp](http://www.orientalmotor.co.jp)