

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.

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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.



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

General

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

Installation

- To prevent the risk of electric shock, use the motor for class I equipment only.
- Install the motor in an enclosure in order to prevent electric shock or injury.
- Install the motor and control unit so as to avoid contact with hands, or ground it to prevent the risk of electric shock.

Connection

- Keep the control unit’s input-power voltage within the specification to avoid fire and electric shock.
- Connect the cables securely according to the wiring diagram in order to prevent fire and electric shock.
- Do not forcibly bend, pull or pinch the cable. Doing so may fire and electric shock.
- To prevent electric shock, be sure to install the terminal cover over the control unit’s terminals after making connections.
- Do not remove the covers attached to the 60 W and 90 W type capacitors.
- The control unit is not equipped with overcurrent protection. Install a device for overcurrent protection (e.g. circuit breaker) before connecting the unit to the power supply. Failure to do so may result in fire.

Operation

- 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.

Maintenance and inspection

- 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.

Repair, disassembly and modification

- 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.

 Caution**General**

- Do not use the motor and control unit beyond their specifications, or electric shock, injury or damage to equipment may result.
- Keep your fingers and objects out of the openings in the motor, 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).

Transportation

- Do not hold the motor output shaft or motor cable. This may cause injury.

Installation

- Keep the area around the motor and control unit 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 and control unit that would obstruct ventilation.
- The motor should be firmly secured on the metallic plate in order to prevent injury and damage to the equipment.
- Provide a cover over the rotating parts (output shaft) of the motor to prevent injury.

Connection

- Install a ground-leakage breaker. Failure to do so may result in fire.

Operation

- Use a motor and control unit only in the specified combination. An incorrect combination may cause a 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.
- 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.
- Before turning on the power to the control unit, set the RUN/STAND-BY switch to STAND-BY and the speed potentiometer to LOW.
- To prevent bodily injury, do not touch the rotating parts (output shaft and cooling fan) of the motor during operation.
- The motor's surface temperature may exceed 70 °C, even under normal operating conditions. If a motor is accessible during operation, post the warning label shown in the figure in a conspicuous position to prevent the risk of skin burn(s).



Warning label

Disposal

- To dispose of the motor or control unit, disassemble it into parts and components as much as possible and dispose of individual parts/components as industrial waste.

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
- Control unit mounting screw (M3) set 1 set
(Screws, washers, nuts 4 pcs. each)
- This operation manual 1 copy

■ Standards and CE marking

Motors and Control units have been designed and inspected according to the following standards.

Recognized name is motor model name and control unit name.

Voluntary display of the CE mark conforming to the Low Voltage Directives.

	Motors	Control units
Standards	UL 1004, UL 2111 CSA C22.2 No.100, CSA C22.2 No.77 GB 12350	UL 508 CSA C22.2 No.14
Applications for standards	EN 60034-1, EN 60034-5, EN 60664-1, EN 60950-1	EN 50178, EN 60950-1
Certification body	UL File No.E64199 (6 W type) UL File No.E64197 (15 to 90 W type) CQC	UL File No.E91291
Installation conditions	Overvoltage category II, Pollution degree 2, Class I (For EN/IEC Standards) 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.	

A Running Heating Test and a Locked-Rotor Test has been conducted with an aluminum radiation plate of size indicated below.

For the motor with a gearhead, tests has been conducted with a gearhead instead of the radiation plate.

Motor frame size [mm (in.)]	Size [mm (in.)]	Thickness [mm (in.)]	Material
□60 (□2.36)	115×115 (4.53×4.53)	5 (0.20)	Aluminum
□70 (□2.76)	125×125 (4.92×4.92)		
□80 (□3.15)	135×135 (5.31×5.31)		
□90 (□3.54), 40 W type	165×165 (6.50×6.50)		
□90 (□3.54), 60 W and 90 W type	200×200 (7.87×7.87)		

Note To ensure conformance with EMC directive be sure to conduct EMC measures with the product assembled in your equipment by referring to 3.5 "Installing and wiring in compliance with EMC directive" on page 10.

■ Hazardous substances

RoHS (Directive 2002/95/EC 27Jan.2003) compliant

2.2 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.

■ 110 V/115 V type

Unit* ¹	Motor	Control unit	Capacitor type	Compatible gearhead* ² (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

Unit* ¹	Motor	Control unit	Capacitor type	Compatible gearhead* ² (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		-		

*1 Unit model name is not the recognized name under the various safety standards.

Recognized name is motor model name and control unit name.

*2 The gear ratio appears at the position in the model number indicated by the box (□).

3 Installation

3.1 Installation conditions

Install the motor and control unit in a location that meets the following conditions.

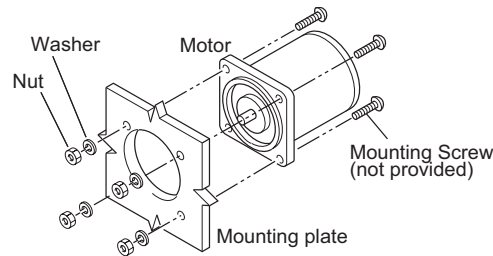
Using the unit in a location that does not satisfy these conditions could damage it.

- 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

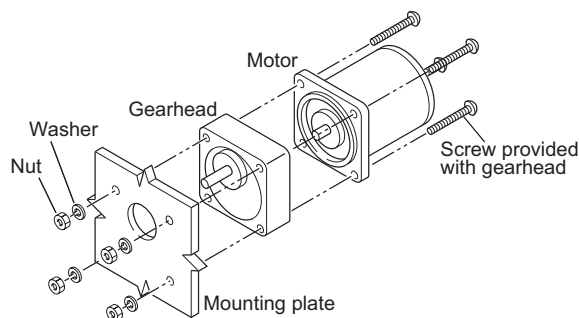
Motor frame size [mm (in.)]	Screw size	Tightening torque [N·m (lb-in)]
□60 (□2.36)	M4	2.0 (17.7)
□70 (□2.76)	M5	2.5 (22)
□80 (□3.15)	M5	2.5 (22)
□90 (□3.54)	M6	3.0 (26)

Note 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 motor'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.
For **5GU□K**, **5GU□KBH**, **5GN□RA** and **5GU□RA** types, screws for mounting to machinery are not provided. M6 screws (for **GN** type) or M8 (for **GU** type) must be provided separately. Mounting bracket is available as an option (sold separately).

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



Note

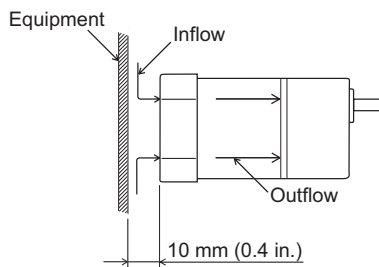
- Confirm gearhead compatibility by checking the table in section 2.2 "Checking the product name and motor-control unit combination" on page 5.
- Keep the motor and gearhead's pilot section free of dirt, as the presence of dirt can result in inadequate fastening and cause grease to leak from the gearhead.
- 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.

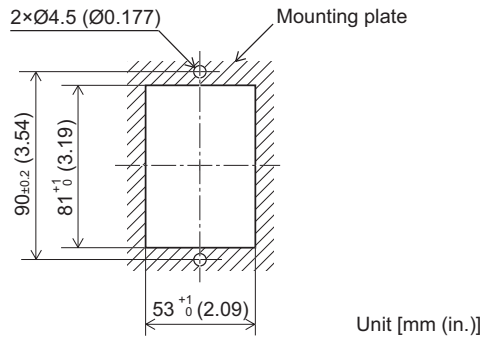
Refer to the mounting methods described below.

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

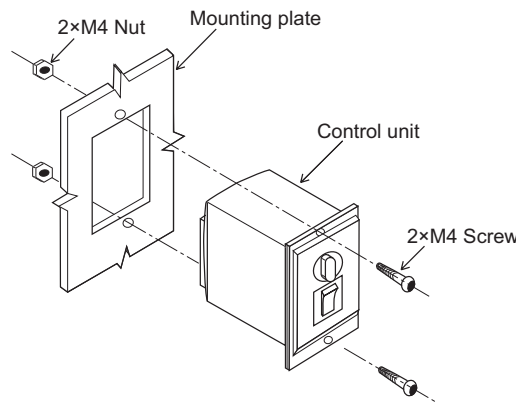
Note Use a tightening torque of 0.7 N·m (6.1 lb-in) or less for the screws.
Tightening them at a torque above 0.7 N·m (6.1 lb-in) could damage the control unit.

■ Installing by opening a square hole

1. Cut a hole in the mounting plate as indicated in the diagram to the left.



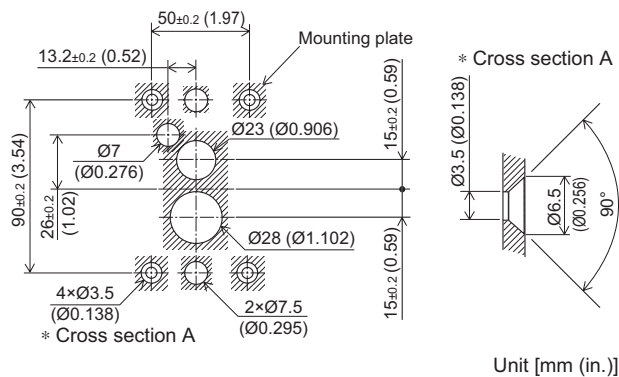
2. Insert the control unit from the front of the mounting plate and fasten with screws and nuts.



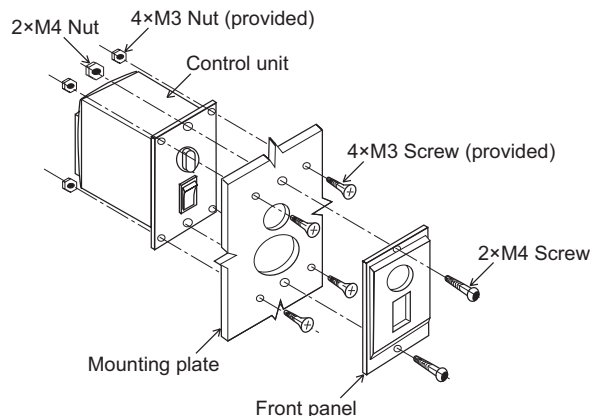
Mounting screws and nuts	
Size	Number
M4	2 of each

■ 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 provided.
4. Fasten the front panel onto the front of the mounting plate using the screws and nuts listed below (not provided).



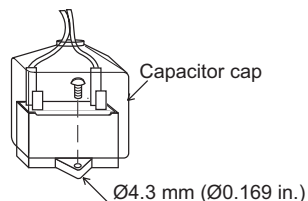
Mounting screws and nuts

Size	Number
M4	2 of each

Note 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 provided).



- Note**
- 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 Installing and wiring in compliance with EMC directive

■ General

- EMC directive (89/336/EEC, 92/31/EEC)

The **US** series has been designed and manufactured for incorporation in general industrial machinery. The EMC directive requires that the equipment incorporating this product comply with these directives.

The installation and wiring method is the basic methods that would effectively allow the customer's equipment to be compliant with the EMC directive.

The compliance of the final machinery with the EMC directive will depend on such factors as configuration, wiring, layout and risk involved in the control-system equipment and electrical parts. It therefore must be verified through EMC measures by the customer of the machinery.

- Applicable standards

EMI

Emission Tests	EN 61000-6-4
Radiated Emission Test	EN 55011
Conducted Emission Test	EN 55011

EMS

Immunity Tests	EN 61000-6-2
Radiation Field Immunity Test	IEC 61000-4-3
Electrostatic Discharge Immunity Test	IEC 61000-4-2
Fast Transient/Burst Immunity Test	IEC 61000-4-4
Conductive Noise Immunity Test	IEC 61000-4-6
Surge Immunity Test	IEC 61000-4-5
Voltage Dip Immunity Test	IEC 61000-4-11
Voltage Interruption Immunity Test	IEC 61000-4-11

■ Installing and wiring in compliance with EMC directive

Effective measures must be taken against the EMI that the **US** series may give to adjacent control-system equipment, as well as the EMS of the **US** series itself, in order to prevent a serious functional impediment in the machinery.

The use of the following installation and wiring methods will enable the **US** series to be compliant with the EMC directive (the aforementioned compliance standards).

- 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, use the products are shown in the below chart, or an equivalent.

TDK Corporation	ZAG2210-11S
EPCOS AG	B84112-B-B110
Schaffer EMC AG	FN2330Y-10-06, FN2310X-10-06
Tyco Electronics CORCOM	10ESK1

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 mm² or more) parallel with the mains-filter output cable (AWG18: 0.75 mm² 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.

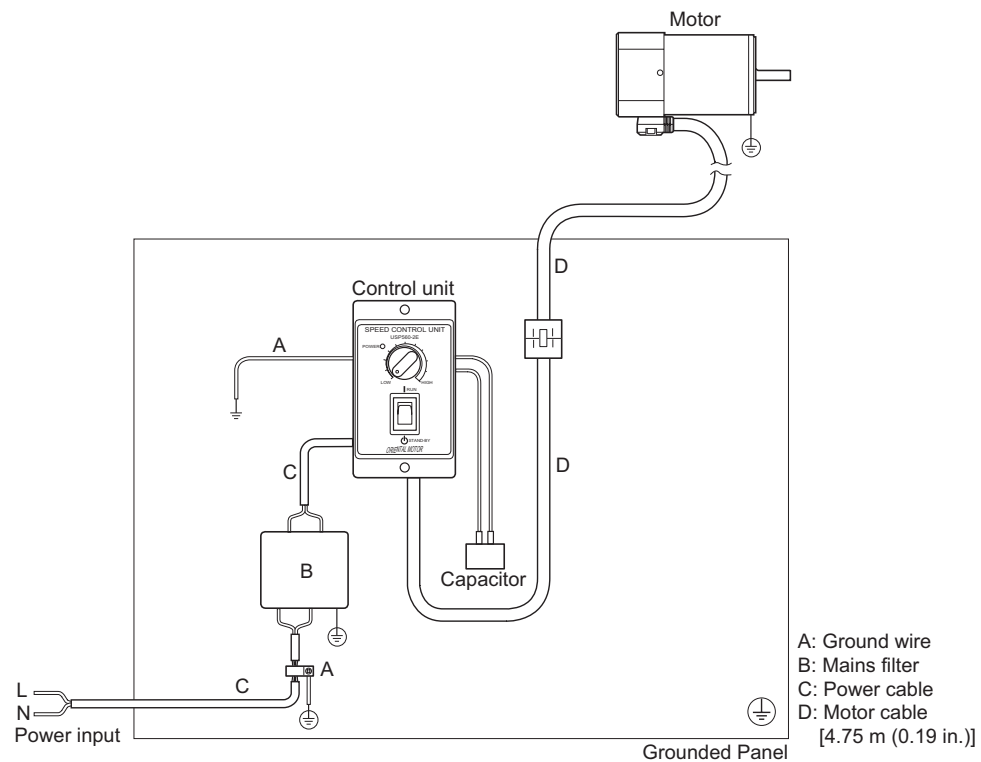
- **Motor cable connection**

When the motor cable is extended, use the optional extension cables (sold separately). Refer to the table of 5.5 “Extension cables” on page 16.

- **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 motor and control unit 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.

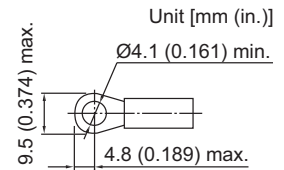
The motors direction of rotation is set in a clockwise direction viewing the motor from the side with the output shaft.

When changing the motors direction, refer to section 5 “Operation” on page 13.

Control unit in illustration is the 110 V/115 V type, with internal capacitor.

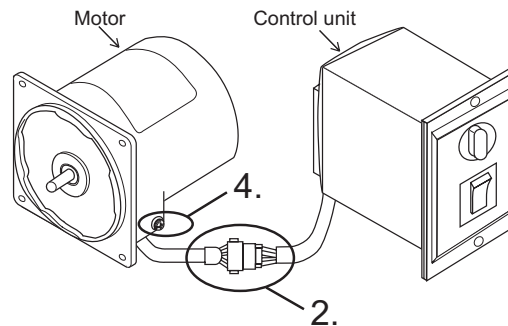
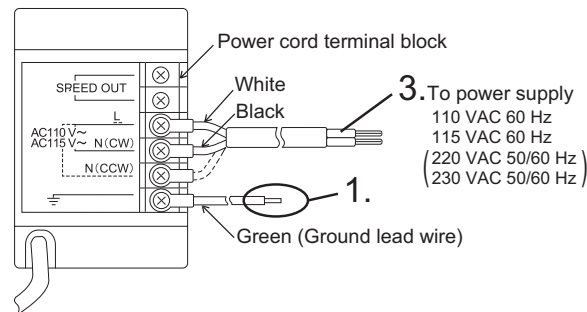
1. Ground the green ground wire to ground. The function of this ground is for eliminating noise.
2. Connect the motor connector to the control unit connector. Make sure the connection is secure by inserting the connectors until you hear the sound of them coupling.
3. Connect the power cord to the power 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 mm²) or more



* For 60 W and 90 W type, the motor is not equipped with protective earth terminals. Refer to “Grounding procedure” on page 11.

Control unit rear panel



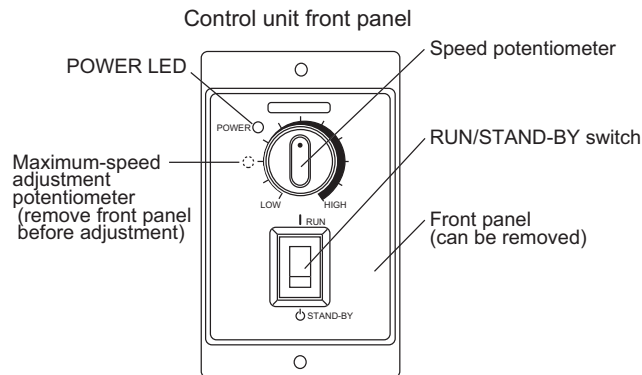
Note Do not use screws other than the protective earth terminal screws attached on the product.

5 Operation

Note

- This motor is B type insulation motor. 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.
- 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



■ 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. (See page 14 for details on how to adjust maximum speed.)

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.

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 2.2 "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).

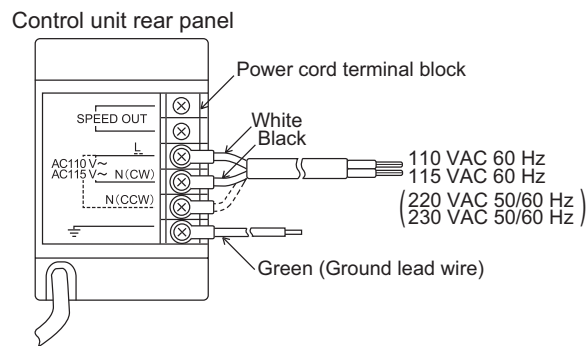
When operating the motor in a counterclockwise direction, connect the lead wires to N (CCW).

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

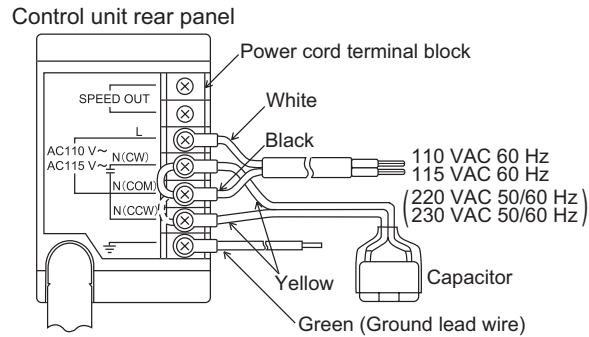
1. Remove the plastic cover over the power cord terminal block on the rear of the control unit.
2. Disconnect the black lead wire connected to the power cord terminal from N (CW) and reconnect it to N (CCW). When the control unit is shipped from the factory, lead wires are connected to power cord terminals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

- Replace the plastic cover over the power cord terminal block.



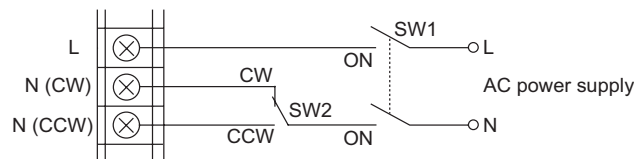
5.3 Switching between rotation directions

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

Note 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.

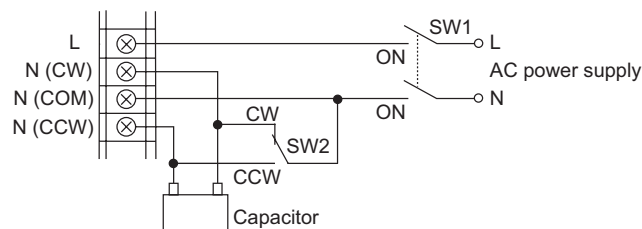
■ Motor with internal capacitor

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



■ Motor with external capacitor

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



■ Contact capacity of the switch

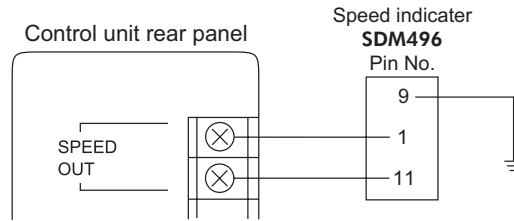
Use the switch of 250 VAC, 5 A or more capacity.

5.4 Checking the motor's speed

Use the **SDM496** digital display model (sold separately).

Connect the power cord SPEED OUT terminals to 1 and 11 on the digital tachometer and the motor's speed will be displayed once the motor begins rotating.

Refer to the **SDM496** digital display model operation manual for connection details.



Note The digital speed indicator **SDM496** is not certified by the recognized safety standards. When the digital speed indicator is used with the **US** series, which is certified by the recognized safety standards and/or the conformed safety standards, the **US** series itself is not in conformance with the safety standards.

5.5 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)

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

6 Characteristics

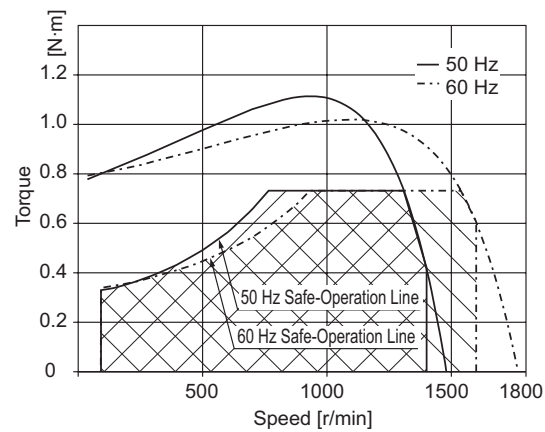
■ Safe-operation line

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 ± 5 °C (266 ± 9 °F)

Power is turned back on at 82 ± 15 °C (180 ± 27 °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 "Connecting" or 5 "Operating"
	The gearhead output shaft's rotation direction differs depending on the gearhead's deceleration ratio. Refer to the gearhead operation manual.
	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.

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