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HM-9121-2

ORIENTAL MOTOR

Non-Contact Speed Control Motor Unit

MSS·W Series

OPERATING MANUAL

<Table of contents>

1. Precautions ..... Page 2
2. Checking the Package Contents ..... Page 3
3. Installation ..... Page 6
4. Connection ..... Page 8
5. Operation ..... Page 16
6. Characteristics ..... Page 20
7. Locked Rotor Burnout Protection ..... Page 20
8. Troubleshooting ..... Page 21

Thank you for purchasing ORIENTAL MOTOR products.
Please read this operating manual thoroughly before installing and operating the motor, and always keep the manual where it is readily accessible.

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1. Precautions

1.1 Precautions for Installation

- Do not use in a place where there is flammable gas and/or corrosive gas.
- Motors and speed control packs for use only in equipment of protection class Ⅰ.
- The motor housing must be mounted with a screw and spring washer to the ground point of the equipment.
- When installing the motor into your equipment, ensure that the motor lead wires are fixed and do not move. In addition, do not apply any pressure to these lead wires.
- Installation must be performed by a qualified installer.
- For the input/output signals, use a DC power supply with reinforced insulation on the primary side.

1.2 Precautions for Operation

- The enclosure temperature of this motor can exceed 70℃(depending on operation conditions). In case motor is accessible during operation, please attach the following warning label so that it is clearly visible.



Warning label

- Always turn off the power to the motors before conducting checks or performing work.
  Thermally protected motors will restart automatically when motor temperature falls below a certain level.

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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 piece
- Speed control pack ..... 1 piece
- Speed control pack base mounting bracket ..... 2 pieces
  Speed control pack back mounting bracket ..... 2 pieces
  Mounting screws (M3) ..... 4 pieces
- External speed potentiomerer ..... 1 piece
  (with adjustment knob, dial plate and insulated sheet)
- Junction cable ..... 1 piece
- Capacitor ..... 1 piece
- Capacitor cap ..... 1 piece
- Manual (This document) ..... 1 piece

Motors and speed control packs have been designed and inspected according to the following standards.
Recognized name is motor model name and speed control pack name.

	Motors	Speed Control Packs
Standards	UL519,UL547,UL1004 CAN/CSA C22.2 No.100, CAN/CSA C22.2 No.77 EN60950	UL508 CAN/CSA C22.2 No.14
Applications for Standards	EN60034-1, EN60034-5 IEC34-11	EN50178, EN60950
Certification Body	UL, VDE	UL
Standards File No.	UL File No.E64199 (6W type) E64197 (15〜90W type) VDE Licence No.114919ÜG (6W type) No.6751ÜG, 6752ÜG or 6753ÜG (15〜90W type)	UL File No.E91291
Installation Conditions	Installation category Ⅱ, Pollution degree 2, Class Ⅰ (For EN50178, EN60950) When the machinary to which the motor and speed control pack is mounted requires installation category Ⅲ and pollution degree 3 specifications, install the motor and speed control pack in a cabinet that comply with IP54 and connect to power supply via an isolation transformer.	

※ Voluntary display of the CE mark conforming to the Low Voltage Directives.
※ The certificate by VDE is valid only for the motor assembly itself. The capacitor is not included in the certificate.
However, both the motor assembly and capacitor combined have been tested against and have passed EN60950 Annex B.8.
※ Application of EN standards for speed control pack is pending.

A running heating test and a locked-rotor test has been conducted with a aluminium 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	size	thickness	material
□60 (□2.36)	115×115 (4.53×4.53)	5 (0.20)	aluminium
□70 (□2.76)	125×125 (4.92×4.92)		
□80 (□3.15)	135×135 (5.31×5.31)		
□90 : 40W type (□3.54)	165×165 (6.50×6.50)		
□90 : 60W, 90W type (□3.54)	200×200 (7.87×7.87)		

※ Dimensions in millimeters(inches).

Note The EMC measurements required under standard EN50178 are not performed separately for motors and speed control packs. Perform the EMC test when they are incorporated into the final product.
The over-voltage protection test required under standard EN50178 is not performed. Perform the test when incorporated into the final product.

■ Standards for accessories

Capacitor	UL File No.83671
Capacitor cap	UL File No.E56078
External speed potentiometer	——
Junction cable	——

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2.2 Checking the Product Name and Motor-Speed Control Pack Combination

This product comes in a combined set consisting of a motor and a speed control pack. When the product first arrives, check the name plates to confirm that you have received the correct motor, capacitor and speed control pack combination.

■ Induction Motor (Continuous Rating)

100V/110V/115V Type

Unit Model ※1	Motor Model	Capacitor Model	Speed Control Pack Model	Compatible Gearhead (sold separately)※2
MSS206-401WJ-□	USM206-401W	**CH35FAUL**	MSP-1W	**2GN□K**
MSS206-001WJ-□	USM206-001W			———
MSS206-401WU-□	USM206-401W	**CH25FAUL**		**2GN□K**
MSS206-001WU-□	USM206-001W			———
MSS315-401WJ-□	USM315-401W	**CH55FAUL**		**3GN□K**
MSS315-001WJ-□	USM315-001W			———
MSS315-401WU-□	USM315-401W	**CH45FAUL**		**3GN□K**
MSS315-001WU-□	USM315-001W			———
MSS425-401WJ-□	USM425-401W	**CH80CFAUL**		**4GN□K,4GN□RH,4GN□RA**
MSS425-001WJ-□	USM425-001W			———
MSS425-401WU-□	USM425-401W	**CH65CFAUL**		**4GN□K,4GN□RH,4GN□RA**
MSS425-001WU-□	USM425-001W			———
MSS540-401WJ-□	USM540-401W	**CH110CFAUL**		**5GN□K,5GN□RH,5GN□RA**
MSS540-001WJ-□	USM540-001W			———
MSS540-401WU-□	USM540-401W	**CH90CFAUL**		**5GN□K,5GN□RH,5GN□RA**
MSS540-001WU-□	USM540-001W			———
MSS560-501WJ-□	USM560-501W	**CH200CFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS560-001WJ-□	USM560-001W			———
MSS560-501WU-□	USM560-501W	**CH180CFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS560-001WU-□	USM560-001W			———
MSS590-501WJ-□	USM590-501W	**CH280CFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS590-001WJ-□	USM590-001W			———
MSS590-501WU-□	USM590-501W	**CH200CFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS590-001WU-□	USM590-001W			———

200V/220V/230V Type

Unit Model ※1	Motor Model	Capacitor Model	Speed Control Pack Model	Compatible Gearhead (sold separately)※2
MSS206-402WJ-□	USM206-402W	**CH08BFAUL**	MSP-2W	**2GN□K**
MSS206-002WJ-□	USM206-002W			———
MSS206-402WE-□	USM206-402W	**CH06BFAUL**		**2GN□K**
MSS206-002WE-□	USM206-002W			———
MSS315-402WJ-□	USM315-402W	**CH15BFAUL**		**3GN□K**
MSS315-002WJ-□	USM315-002W			———
MSS315-402WE-□	USM315-402W	**CH10BFAUL**		**3GN□K**
MSS315-002WE-□	USM315-002W			———
MSS425-402WJ-□	USM425-402W	**CH18BFAUL**		**4GN□K,4GN□RH,4GN□RA**
MSS425-002WJ-□	USM425-002W			———
MSS425-402WE-□	USM425-402W	**CH15BFAUL**		**4GN□K,4GN□RH,4GN□RA**
MSS425-002WE-□	USM425-002W			———
MSS540-402WJ-□	USM540-402W	**CH30BFAUL**		**5GN□K,5GN□RH,5GN□RA**
MSS540-002WJ-□	USM540-002W			———
MSS540-402WE-□	USM540-402W	**CH23BFAUL**		**5GN□K,5GN□RH,5GN□RA**
MSS540-002WE-□	USM540-002W			———
MSS560-502WJ-□	USM560-502W	**CH50BFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS560-002WJ-□	USM560-002W			———
MSS560-502WE-□	USM560-502W	**CH40BFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS560-002WE-□	USM560-002W			———
MSS590-502WJ-□	USM590-502W	**CH70BFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS590-002WJ-□	USM590-002W			———
MSS590-502WE-□	USM590-502W	**CH60BFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS590-002WE-□	USM590-002W			———

※1 The number in the box (□) represents the length of the junction cable for the unit models.
If there is no box (□), the junction cable is 50cm long .

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

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■ Reversible Motor (30 Minute Rating)

100V/110V/115V Type

Unit Model ※1	Motor Model	Capacitor Model	Speed Control Pack Model	Compatible Gearhead (sold separately)※2
MSS206-411WJ-□	USM206-411W	**CH45FAUL**	MSP-1W	**2GN□K**
MSS206-011WJ-□	USM206-011W			———
MSS206-411WU-□	USM206-411W	**CH35FAUL**		**2GN□K**
MSS206-011WU-□	USM206-011W			———
MSS315-411WJ-□	USM315-411W	**CH75CFAUL**		**3GN□K**
MSS315-011WJ-□	USM315-011W			———
MSS315-411WU-□	USM315-411W	**CH60CFAUL**		**3GN□K**
MSS315-011WU-□	USM315-011W			———
MSS425-411WJ-□	USM425-411W	**CH100CFAUL**		**4GN□K,4GN□RH,4GN□RA**
MSS425-011WJ-□	USM425-011W			———
MSS425-411WU-□	USM425-411W	**CH80CFAUL**		**4GN□K,4GN□RH,4GN□RA**
MSS425-011WU-□	USM425-011W			———
MSS540-411WJ-□	USM540-411W	**CH160CFAUL**		**5GN□K,5GN□RH,5GN□RA**
MSS540-011WJ-□	USM540-011W			———
MSS540-411WU-□	USM540-411W	**CH120CFAUL**		**5GN□K,5GN□RH,5GN□RA**
MSS540-011WU-□	USM540-011W			———
MSS560-511WJ-□	USM560-511W	**CH250CFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS560-011WJ-□	USM560-011W			———
MSS560-511WU-□	USM560-511W	**CH200CFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS560-011WU-□	USM560-011W			———
MSS590-511WJ-□	USM590-511W	**CH350CFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS590-011WJ-□	USM590-011W			———
MSS590-511WU-□	USM590-511W	**CH300CFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS590-011WU-□	USM590-011W			———

200V/220V/230V Type

Unit Model ※1	Motor Model	Capacitor Model	Speed Control Pack Model	Compatible Gearhead (sold separately)※2
MSS206-412WJ-□	USM206-412W	**CH10BFAUL**	MSP-2W	**2GN□K**
MSS206-012WJ-□	USM206-012W			———
MSS206-412WE-□	USM206-412W	**CH08BFAUL**		**2GN□K**
MSS206-012WE-□	USM206-012W			———
MSS315-412WJ-□	USM315-412W	**CH18BFAUL**		**3GN□K**
MSS315-012WJ-□	USM315-012W			———
MSS315-412WE-□	USM315-412W	**CH15BFAUL**		**3GN□K**
MSS315-012WE-□	USM315-012W			———
MSS425-412WJ-□	USM425-412W	**CH25BFAUL**		**4GN□K,4GN□RH,4GN□RA**
MSS425-012WJ-□	USM425-012W			———
MSS425-412WE-□	USM425-412W	**CH20BFAUL**		**4GN□K,4GN□RH,4GN□RA**
MSS425-012WE-□	USM425-012W			———
MSS540-412WJ-□	USM540-412W	**CH40BFAUL**		**5GN□K,5GN□RH,5GN□RA**
MSS540-012WJ-□	USM540-012W			———
MSS540-412WE-□	USM540-412W	**CH35BFAUL**		**5GN□K,5GN□RH,5GN□RA**
MSS540-012WE-□	USM540-012W			———
MSS560-512WJ-□	USM560-512W	**CH60BFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS560-012WJ-□	USM560-012W			———
MSS560-512WE-□	USM560-512W	**CH50BFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS560-012WE-□	USM560-012W			———
MSS590-512WJ-□	USM590-512W	**CH80BFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS590-012WJ-□	USM590-012W			———
MSS590-512WE-□	USM590-512W	**CH70BFAUL**		**5GU□KB,5GU□KBH,5GU□RH,5GU□RA**
MSS590-012WE-□	USM590-012W			———

※ 1 The number in the box (□) represents the length of the junction cable for the unit models.
If there is no box (□), the junction cable is 50cm long .

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

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3. Installation

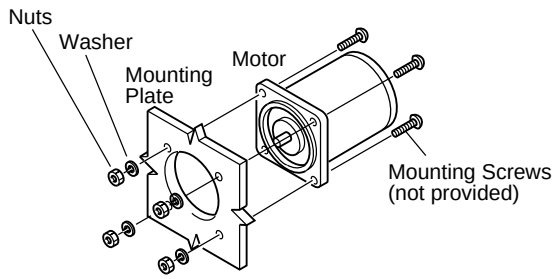
Installation conditions

Install the motor and speed control pack 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℃(14 ℉) ～ +50℃(122 ℉) (avoid freezing)
  -10℃(14 ℉) ～ +40℃(104 ℉) for single-phase 230V
  Speed Control Pack : 0℃(32 ℉) ～ +40℃(104 ℉) (avoid freezing)
- Ambient humidity : 85% max. (avoid condensation)
- Not exposed to explosive, flammable, or corrosive gas
- Not exposed to direct sunlight
- Not exposed to dust
- Not exposed to water or oil
- A place where heat can escape easily
- Not exposed to continuous vibration or excessive impact
- 1,000 meters or less above sea level
- Installation category Ⅱ, Pollution degree 2, Class Ⅰ (For EN50178, EN60950)
  When the machinary to which the motor and speed control pack is mounted requires installation category Ⅲ and pollution degree 3 specifications, install the motor and speed control pack in a cabinet that comply with IP54 and connect to power supply via an isolation transformer.

3.1 Mounting the Motor

(1) Round shaft motor



(1)Drill holes in the mounting plate that match the screws and the motor's dimensions.

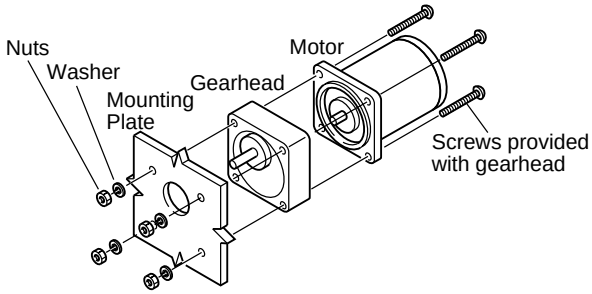
(2)Use screws, washers, and nuts listed below to fasten the motor to the mounting plate. Make sure that no gaps are left between the motor and the surface of the mounting plate. Use screws of an appropriate length.

Mounting screws

Motor Frame size	Screw size	Tightening torque
□60mm	M4	2.0N･m (20kgcm)
□70mm	M5	2.5N･m (25kgcm)
□80mm	M5	2.5N･m (25kgcm)
□90mm	M6	3.0N･m (30kgcm)

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.

(2) Pinion shaft motor



(1)Drill holes in the mounting plate that match the screws and the motor's dimensions.

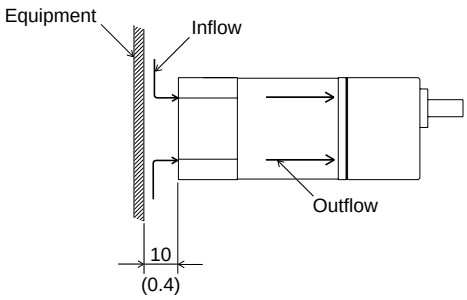
(2)Attach the motor and gearhead using the screws supplied with the gearhead (sold separately). Attach by using the pilot section as a guide and rotating the gearhead gently left and right, being careful that the shaft's gear pinion section does not strike the gearhead side plate (metal plate) or gears 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.
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".
Scratches and dents on the gears can cause unusual sound.

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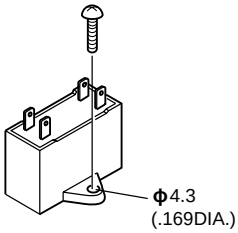
(3)Motor with cooling fan



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

※ Dimensions in millimeters (inches).

3.2 Mounting the Capacitor



Check to see that the capacitor is the one you ordered before installation.
Use M4 screws to install the capacitor.

※ Dimensions in millimeters(inches).

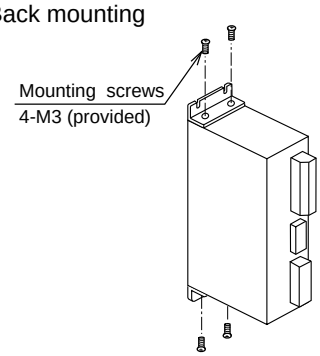
Note Do not let the screw fastening torque exceed 1N・m (10kgcm) to prevent damage to the mounting feet.
Mount capacitor at least 10cm (3.94inches) away from the motor. If it is located closer, the life of the capacitor will be shortened.

3.3 Speed Control Pack Installation

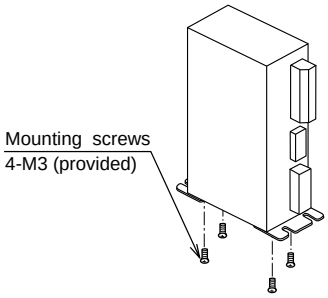
(1) Speed control pack installation

The speed control pack can be mounted on machinery using the mounting brackets provided.
To improve ventilation, mount the speed control pack in an upright position as shown in the figures below.

Back mounting

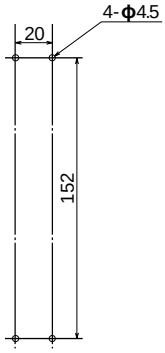


Base mounting

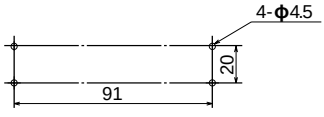


■ Mounting dimensions [unit : mm]

Back mounting



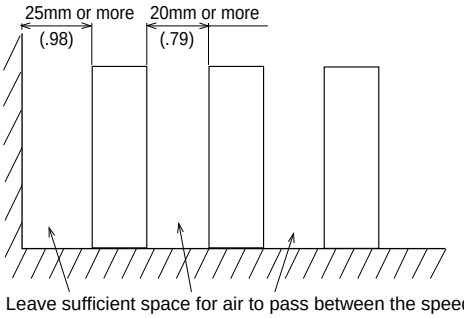
Base mounting



Note
- When mounting the speed control pack in a tightly close up place like the control panel and a place where there is a heating nearby , be sure to when the speed control pack ambient temperature exceed 40℃, cool the speed control pack with a fan.
- Optional mounting plate for DIN rail (sold separately) are available from ORIENTAL MOTOR.

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(2) Mounting two or more speed control packs



Leave sufficient space for air to pass between the speed control packs.

When mounting two or more speed control packs, separate them by a space of at least 20mm. Leave at least 25mm between of space the speed control pack and other devices or structures.

4. Connection

4.1 Names and Functions of Speed Control Pack

The illustration below shows for **MSP-1W**.

LED			
Display	Color	Function	Conditions under which light goes on
POWER	green	Power indicator	When both the AC power and the DC power are on
CW	green	Signal input indicator	When a signal is input to CW
CCW	green	Signal input indicator	When a signal is input to CCW
SET	green	Speed setting method indicatator	When a signal is input to SPEED SET
FREE	green	Signal input indicator	When a signal is input to FREE

Internal speed potentiometer
See page 12

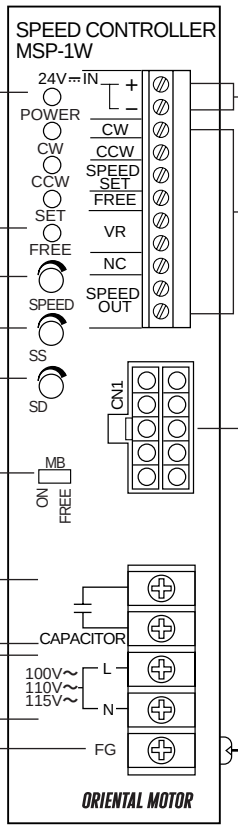
Slow start/slow down time controller
See page 17

Do not use this switch.
Leave it at the factory setting ON.

⑬、⑭ Capacitor connection terminals

⑮、⑯ Power supply input terminals

⑰ Frame ground terminal



①、② Signal power supply terminals
Connect the DC24V power supply

③～⑪ Signal input/output terminals

Name	Signal
③ CW	Clockwise rotation input
④ CCW	Counterclockwise rotation input
⑤ SPEED SET	Speed controller switch input
⑥ FREE	Brake release input
⑦、⑧ VR	Speed control input
⑨ NC	————
⑩、⑪ SPEED OUT	Speed out (Rategenerator Signal)

⑫ Connector for motor

⑱ Protective earth terminal (Screw size : M4)

Speed Control Pack Front Panel

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■ Signal power supply terminals

① 24V⎓IN ＋(power supply for signals)
Connect " ＋ " side of the DC24V power supply for the signal input.

② 24V⎓IN －(power supply for signals)
Connect " － " side of the DC24V power supply for the signal input.

■ Signal input/output terminals

③ CW (clockwise rotation input)
Input terminal for clockwise rotation.

④ CCW (counterclockwise rotation input)
Input terminal for counterclockwise rotation.

⑤ SPEED SET (speed controller switch input)
To select the built-in speed potentiometer, turn this input on (switch to low); to select the external speed potentiometer (or DC power supply) turn this input off (switch to high).

⑥ FREE (brake release input)
Switching brake release input off (switch to high) and then switching both clockwise rotation input and counterclockwise rotaion input off (switch to high) makes the dynamic brake go into operation automatically and stops the motor instantaneously.
Switching brake release input on (switch to low) and then switching both clockwise rotation input and counterclockwise rotation input off (switch to high) makes the motor come to a free stop.

⑦ , ⑧ VR (speed control input)
Connect terminal for setting speed via external speed controller or direct current voltage.

⑨ NC
Not used.

⑩ , ⑪ SPEED OUT (speed signal output)
Use when monitoring the rate of rotation.

■ Connector for motor

⑫ Port for connecting the junction cable.

■ Capacitor connection terminals

⑬ , ⑭ CAPACITOR
Port for connecting the provided capacitor.
Use a wire at least AWG20(0.5mm^2).

■ Power supply connection

⑮ , ⑯ L,N (power supply input terminals)

MSP-1W

AC100V ± 10% 50/60Hz, AC110V ± 10% 60Hz, AC115V ± 10% 60Hz (power supply connection)

MSP-2W

AC200V ± 10% 50/60Hz, AC220V ± 10% 60Hz, AC230V ± 10% 50/60Hz (power supply connection)

⑰ FG (frame ground)

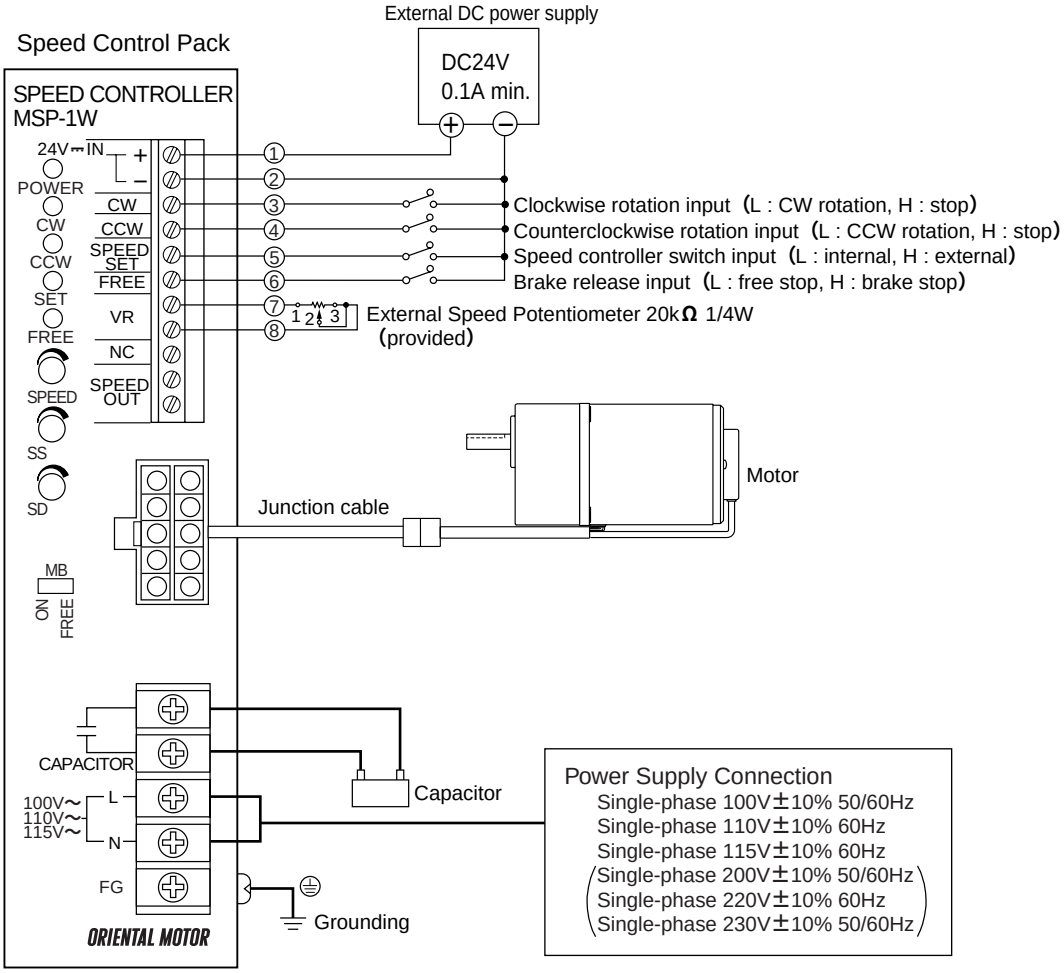
⑱ Protective earth
Use a wire with a cross sectional area of at least AWG18(0.75mm^2).

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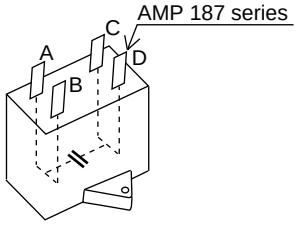
4.2 Examples of Connections

Note
- In the connection diagram, the bold lines indicate the power lines, and the other lines indicate signal lines. Large current run through the bold lines indicated in the connecting diagrams. Use wires with cross sectional area of AWG18(0.75mm^2) or larger for these lines.
- Use one speed control pack per motor.
- Replace the plastic cover over the power cord terminal block.

The illustration below shows for **MSP-1W**



■ Capacitor connection



The capacitor internal wiring is as follows:
Capacitor terminals are internally electrically connected in twos ; A-B and C-D for easy connection.
For easy to install terminals use 187 series AMP FASTON Terminals.
For lead wire connection, use one lead wire for each individual terminal.

4.3 Motor and Speed Control Pack Connections

Using the junction cable.
Connect one end of the junction cable to the motor and the other end to the speed control pack motor connector.

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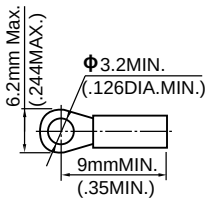
4.4 Connecting Speed Control Pack and Power Supplies

Use a power supply cable whose wire has a cross sectional area of at least AWG18(0.75mm^2).
The speed control pack must be grounded with the ground wire of the protective ground terminal and the frame ground terminal.
The ground line must be as short as possible using wire type AWG18(0.75mm^2) or greater.
Be sure to put in the terminal cover after connecting.

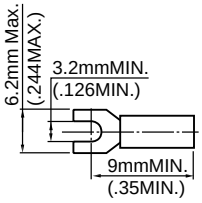
Screw tightning torque : 0.8N・m (8kgcm)

■ Recommended terminal rings for M3

・Round shape terminal with insulation

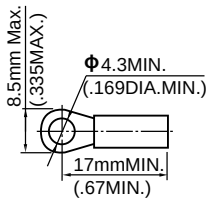


・U-shape terminal with insulation

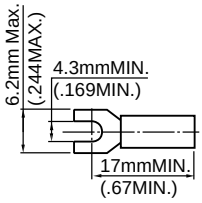


■ Recommended terminal rings for M4

・Round shape terminal with insulation

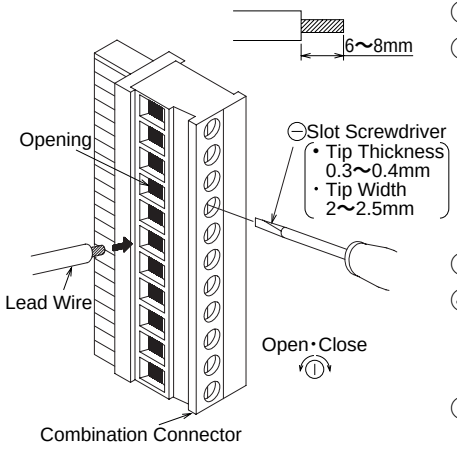


・U-shape terminal with insulation



Note Once power has been turned off, do not turn power on again or remove or insert the motor connector until the POWER LED is completely extinguished (at least 10 seconds).

4.5 Conneting to Signal Input/Output Terminals

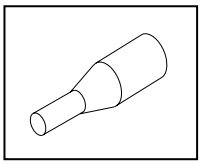


① Remove the combination connector from the speed control pack.
② Cut back the wire insulation 6〜8mm from the end of the wire and twist the wire strands together.
・Use wire type : AWG28 〜 16 (0.88 〜 1.5mm^2)
・Be sure that no loose wire stands cause a short circuit with the adjacent terminal.
・Do not solder the ends of the lead wires as this may result in a poor connection contact.
③ Use a slot screwdriver to loosen and fully open the combination connector opening.
④ Insert the lead wire into the connector and tighten the screw.
・Tightening torque : 0.22 〜 0.25N・m (2.2 〜 2.5kgcm)

⑤ Install the combination connector to the speed control pack.

If using a crimp terminal for connection, use the type indicated in the illustration below.

Pheonix terminal



AI	0.25-6	Appropriate Wire Gage : AWG26 〜 24 (0.14 〜 0.2mm^2)
AI	0.34-6	Appropriate Wire Gage : AWG22 (0.35mm^2)
AI	0.5-6	Appropriate Wire Gage : AWG20 (0.5mm^2)
AI	0.75-6	Appropriate Wire Gage : AWG18 (0.75mm^2)

4.6 Methods of Speed Setting and Their Connection

(1) The following three methods of setting speed can be used with **MSS・W** units.

■ Internal speed potentiometer

Motor speed can be adjusted by turning the potentiometer screw on the speed control pack's front panel. This method is suitable for infrequent speed changes and two-speed control.

■ External speed potentiometer (provided)

Speed settings can be controlled remotely using the external speed potentiometer provided with the unit. This method is suitable when adjusting speed from a control panel.

■ External DC voltage

The motor speed can be changed with DC voltages of 0-5 V.
Have ready a DC power supply of 10mA or more.

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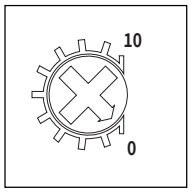
(2) Connection Methods

■ Internal speed potentiometer

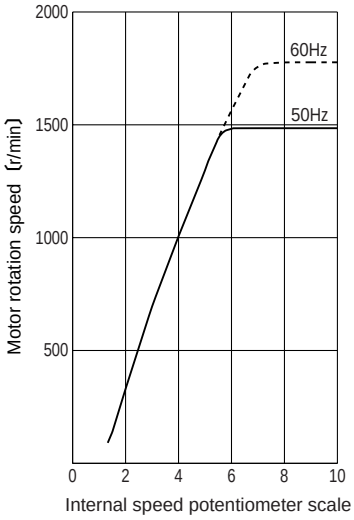
The internal speed potentiometer can be selected by turning on (switch to low) input to the SPEED SET terminal ⑤.

The speed is set to 0r/min when the product is shipped.

Rotate clockwise to start the motor rotating.



Internal speed potentiometer



Internal speed potentiometer scale
-rotation speed characteristics
(Representative Values)

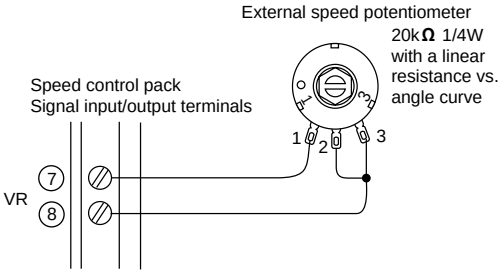
■ External speed potentiometer

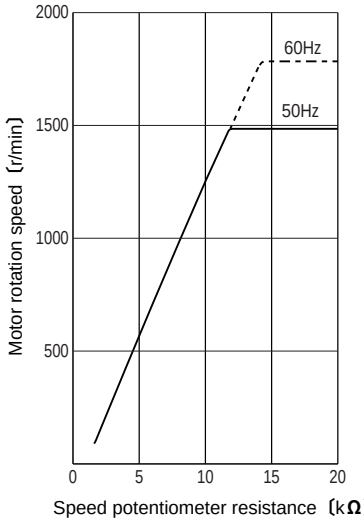
The external potentiometer can be selected by turning off (switch to high) input to the SPEED SET terminal ⑤.

The external speed potentiometer is connected as shown in the following diagram below using the lead wire.

When connecting, turn the external speed potentiometer's knob counterclockwise and set the speed 0r/min.

In this case high-speed operation can be set when turning the external potentiometer'knob clockwise.





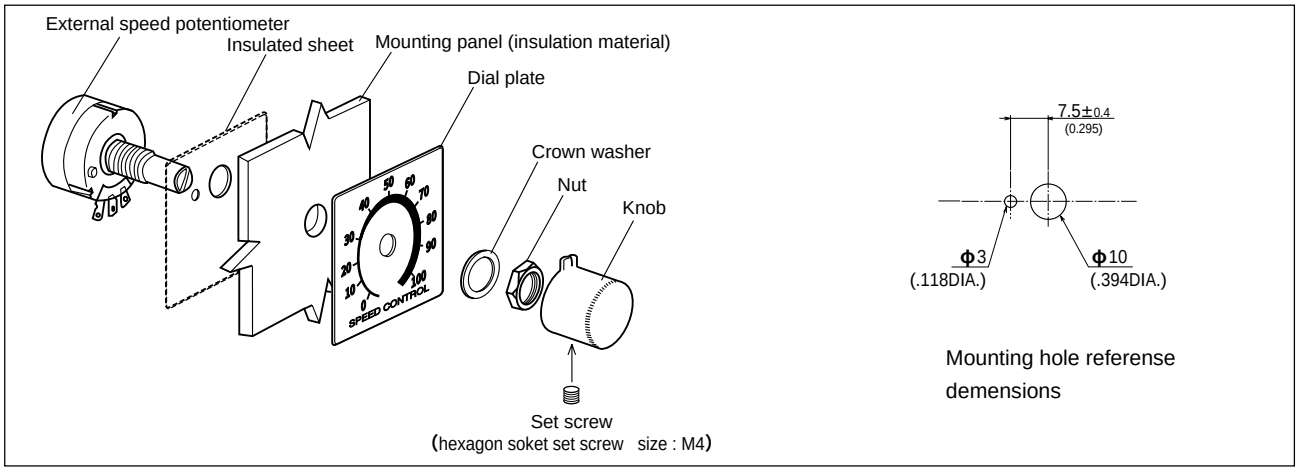
External speed potentiometer resistance
-rotation speed characteristics
(Representative Values)

<External speed potentiometer installation**>**

① Attach the speed potentiometer using the insulated sheet to the mounting panel as follows.

② Attach the dial plate and crown washer, and fix by nut. (fastening torque : less than 0.45N･m [4.5kgcm])

③ Attach the knob, and fix by setscrew. (fastening torque : less than 0.4N･m [4kgcm])

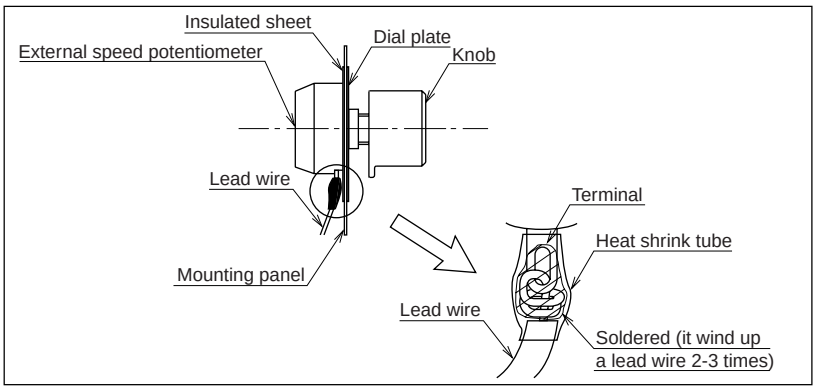


Example of the installation of the external speed potentiometer

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<External speed potentiometer soldering terminal>

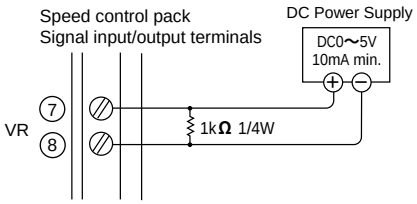
Fix the external speed potentiometer terminal and lead wire in place with a heat shrink tube or the like.
Please follow the following method.
The figure below shows how terminals are processed.



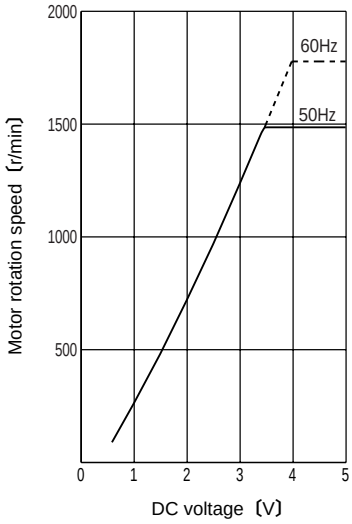
① Pass the lead through the terminal hole and wrap it two or three times.
② Solder the lead wire to the terminal.
③ Cover the soldered area with a heat shrink tube.

■ External DC voltage

The external DC voltage can be selected by turning off (switch to high) input to the SPEED SET terminal ⑤.
To connect an external DC voltage, connect the plus wire to the terminal ⑦, the minus wire to the terminal ⑧.
High speed operation can be set when DC voltage of the external DC supply is elevated.



Note Ensure that there are no errors in positive and negative polarity . This could result in faulty operation and damage the speed control pack.



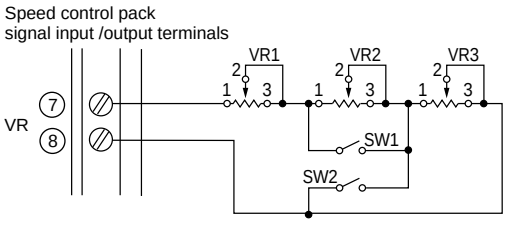
DC voltage-rotation speed characteristics
(Representative Values)

(3) To change speed in stages : Use external and internal speed potentiometers

There are two methods of changing speed in stages.

■ Using two or more external speed potentiometers

Speed can be changed in stages by using multiple external speed potentiometers. The number of stages corresponds to the number of external speed potentiometers.



SW1 \ SW2	ON	OFF
ON	VR1	VR1+VR3
OFF	VR1+VR2	VR1+VR2+VR3

- Set the low speed with VR1 with SW1 and SW2 on.
- Set the medium speed with VR2 with SW1 off and SW2 on.
- Set the high speed with VR3 with SW1 and SW2 off. Keep in mind that changing VR1 and VR2 affects other speeds also.

■ Using an internal and an external speed potentiometer together

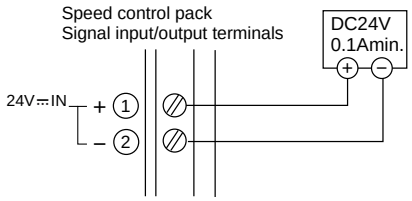
Speed can be changed in stages by switching between an internal and an external speed potentiometer.

・The internal speed potentiometer can be selected by turning on (switch to low) input to the SPEED SET terminal ⑤.
・The external speed potentiometer can be selected by turning off (switch to high) input to the SPEED SET terminal ⑤.

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4.7 Signal Power Supply Connection

A DC24V signal input power supply is required to operate the photocoupler.
Connect the power supply as follows.

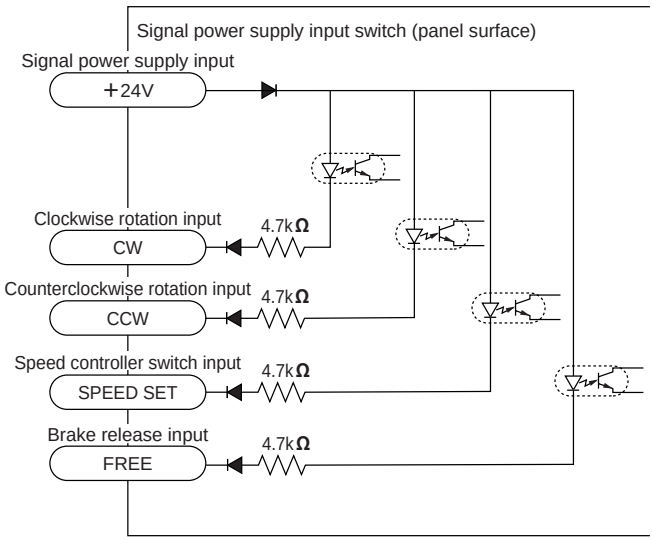


- Connet the DC24V power supply to signal power supply input terminal ① and ② .
- Use a DC power supply with a capacity of 0.1A or greater.

4.8 Connection to Signal Input Terminals

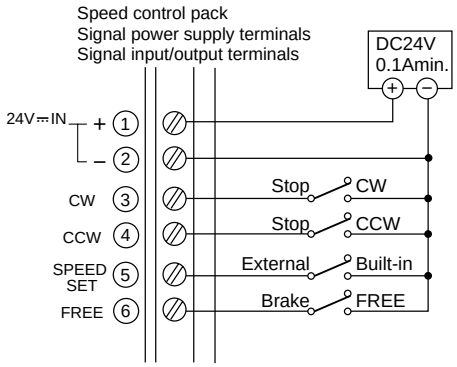
There are 4 signal input terminals : CW (clockwise rotation input), CCW (counterclockwise rotation input), SPEED SET (speed controller switch input), and FREE (brake release input) . The motor's movement can be controlled by inputting signals to these 4 terminals.

(1) **MSP-1W**(**MSP-2W**) Internal Equivalent Circuit Diagram



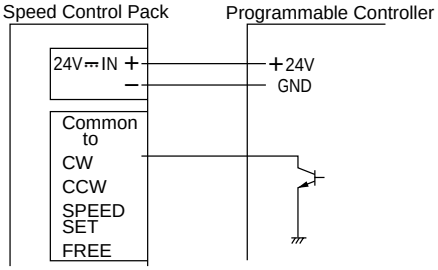
Clockwise rotation input, counterclockwise rotation input, speed controller switch input, and brake release input are performed by photocoupler input. The internal equivalent circuits are as shown in this diagram.

(2) Control by Small Capacity Relays or Switches



Switch capacity : DC24V, 10mA

(3) Control by Programmable Controller (Transistor output type)



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4.9 Noise Control

(1) External Noise Control (prevention of interference)

When excessive external noise works its way into the speed control pack, malfunctions can result.
To prevent problems caused by noise, take the following countermeasures.

■ Power supply lines

- Separate the power line of the noise source from the speed control pack's power line.
- Insert line filters and/or surge for effective noise reduction between the speed control pack and the power supply lines. The filters/suppressors should be inserted as close to the speed control pack as possible.

■ Signal lines(I/O)

- Keep the signal line as short as possible (2 meters or less).
- When setting speed by means of the external speed potentiometer or a DC voltage, use the shield signal line.
- Separate power lines at least 30 cm from any cable running a large current.

■ Motor cable

Place motor cable at least 30 cm away from any cable running a large current.

■ Grounding

The class 3 grounding is required for FG terminals. Also, wiring must be as short as possible. Use AWG18(0.75mm^2) or better as the wiring materials for grounding.

(2) Radio Frequency Interference (RFI) Control

There may be cases in which sensors, radio controls, and computers may malfunction, since the speed control pack creates noise. To prevent problems caused by noise, take the following countermeasures.

■ Power supply lines

- The power supply of the speed control pack should be separated from other instruments which are easily affected by noises.
- Insert line filters and/or surge for effective noise reduction between the speed control pack and the power supply lines. The filters/suppressors should be inserted as close to the speed control pack as possible.

■ Motor cable

When the motor is installed near instruments which are easily affected by noise, store the speed control pack in a grounded metallic case, and route the motor cables into grounded metal conduit.

■ Grounding

The class 3 grounding is required for FG terminals. Also, wiring must be as short as possible. Use AWG18(0.75mm^2) or better as the wiring materials for grounding.

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5. Operation

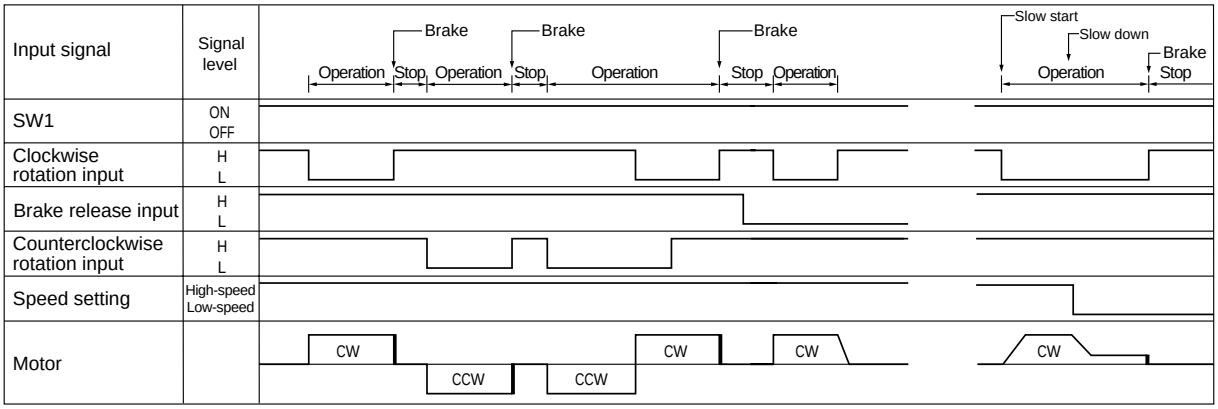
5.1 Operating the Motor

Control of operation, stopping, switching direction of rotation and instantaneous stopping can all be performed with clockwise rotation input, brake release input, and counterclockwise rotation input signals.

(1) Mode Table for Signal Input

Mode \ Signal input	Clockwise rotation	Counterclockwise rotation	Brake release
Clockwise rotation	ON (LOW)	ON or OFF	ON or OFF
Counterclockwise rotation	OFF (HIGH)	ON (LOW)	ON or OFF
Instantaneous stop	OFF (HIGH)	OFF (HIGH)	OFF (HIGH)
Free stop	OFF (HIGH)	OFF (HIGH)	ON (LOW)

(2) Signal Input Timing Chart



(3) CW and CCW Operation

When CW or CCW input is turned on (switch to low), the motor accelerates to the selected speed for the length of time set on the acceleration time potentiometer. If CW and CCW are input simultaneously, CW has priority. Thus, if CCW input is left on, direction can be changed instantaneously by turning the CW input on and off (only reversible motor).
However, under certain power supply voltages or load conditions, change of direction may be delayed.

Note When the motor is operated with the gearhead attached, the gearhead's output shaft may, depending on the gear ratio, turn in the opposite direction of the motor shaft.
See the operating manual of gearhead for information concerning the direction of rotation of the gearhead output shaft.

(4) Instantaneous Stopping and Free Stopping

■ Instantaneous stopping

Switching brake release input OFF and then switching both clockwise rotation input and counterclockwise rotation input OFF makes the dynamic brake go into operation automatically and stops the motor instantaneously.
During an instantaneous stop, the dynamic brake sends a braking current for 0.2-0.4 seconds.

■ Free stopping (stopping the motor without applying the brake)

Switching brake release input ON and then switching both clockwise rotation input and counterclockwise rotation input OFF makes the motor come to a free stop.

(5) Changing Speeds

Speed can be changed by selecting the external speed potentiometer or the internal speed potentiometer by means of signal input to SPEED SET (speed controller switch input) as given in the table below. Speed can be changed while the motor is running. The rate of acceleration/deceleration depends on the time set for acceleration / deceleration.

SPEED SET (speed controller switch)	Speed Potentiometer Selected	Speed Setting Range
OFF (HIGH)	External speed potentiometer	50Hz : 90〜1400r/min, 60Hz : 90〜1600r/min
ON (LOW)	Internal speed potentiometer	

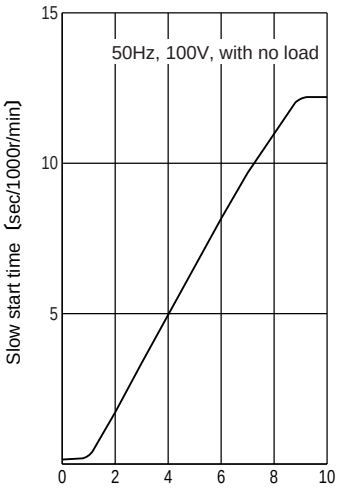
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5.2 Slow start / slow down

Equipment and work pieces are subject to large acceleration/deceletaion force at start, stop, and when changing speeds.
When you want to accelerate/decelerate without any accompanying shock, the acceleration/deceleration time can be extended using the slow start/slow down function.
The slow start/slow down time can be set using the slow start/slow down time controller built into the control pack. However, when the load inertia is large, the slow down time may be longer than the slow down time set.

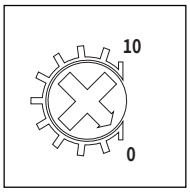
(1)Slow start

The illustration below shows for induction motor type.



Slow start time controller scale
(Representative Values)

The slow start funciton is activated at startup and after switching to high speed. To not use slow start, set the slow start time controller to 0.

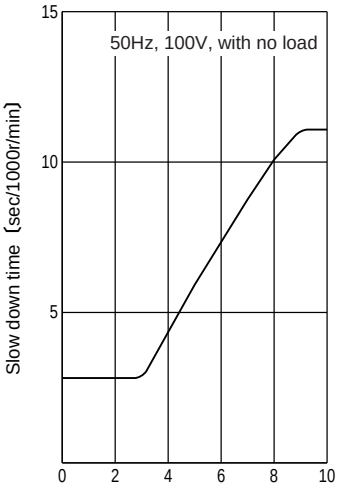


factory setting : 0

Slow start time controller

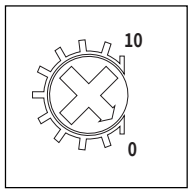
(2)Slow down

The illustration below shows for induction motor type.



Slow down time controller scale
(Representative Values)

The slow down function is activated after switching from high speed to low speed. To not use slow down, set the slow down time controller to 0.



factory setting : 0

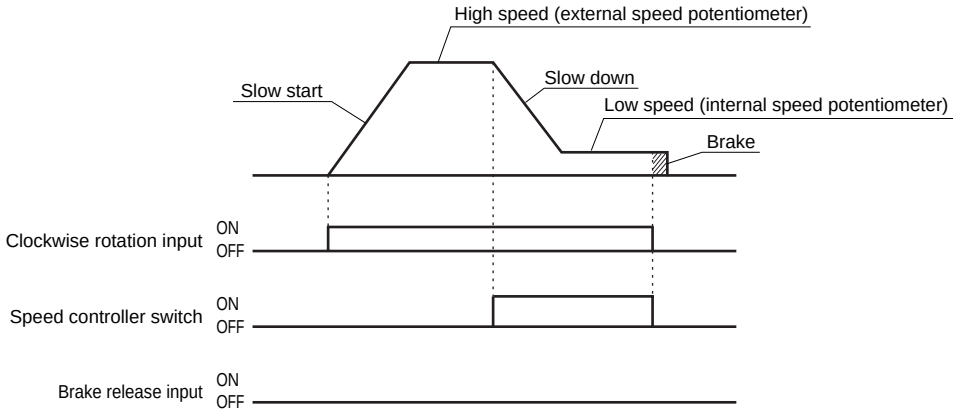
Slow down time controller

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Example 1 : Two-speed control (method of improving stop position precision)

When performing two-speed control using external and internal speed potentiometers, follow the example shown below when using the slow start / slow down function. In this example, high speed is set with an external speed potentiometers and low speed with the internal speed potentiometer.

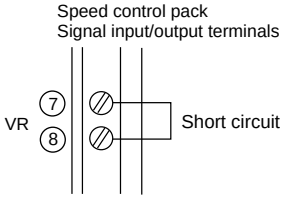
As indicated in this example, once the speed has been adequately reduced with the slow down function the motor can be stopped without any shock and the stop position can be determined with greater precision.



Example 2 : Slowing down to a stop

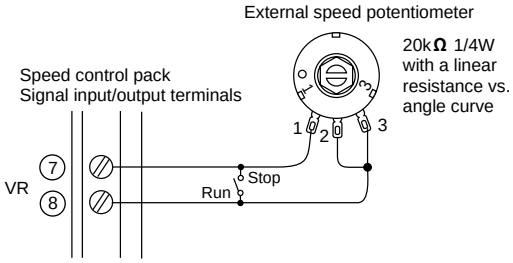
The slow down function is activated after switching to low speed. Setting the speed setting to 0 r/min will cause the motor to slow down to a stop.

■ Using an internal speed potentiometer



Short-circuting speed control input termianals ⑦ and ⑧ as shown in the diagram beforehand and then switching the speed controller switch input OFF (setting for selection of an external speed potentiometer), makes the motor slow down to a stop. To start up again, switch the speed controller switch input ON.

■ Using an external speed potentiometer



Installing a switch between terminals ⑦ and ⑧ as shown in the diagram and then closing the switch, makes the motor slow down to a stop. Leave the rotation input in operating mode. To start up again , open this switch.

■ Using DC voltage

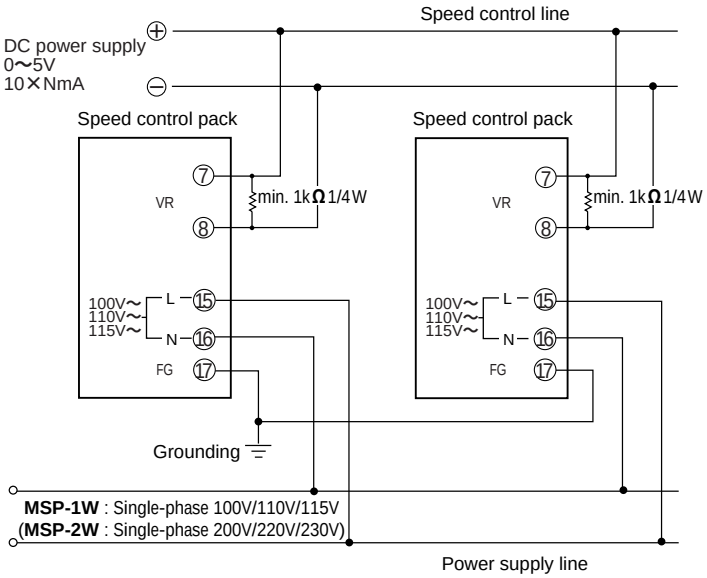
Setting the voltage to 0V makes the motor slow down to a stop.

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5.3 Multi-Motor control

Two or more motors and speed control pack can be operated at the same speed by using a DC power supply or the external speed potentiometer. Connections for the motor and control devices are not shown in the diagram.

(1) Control with the Same DC Voltage Signal

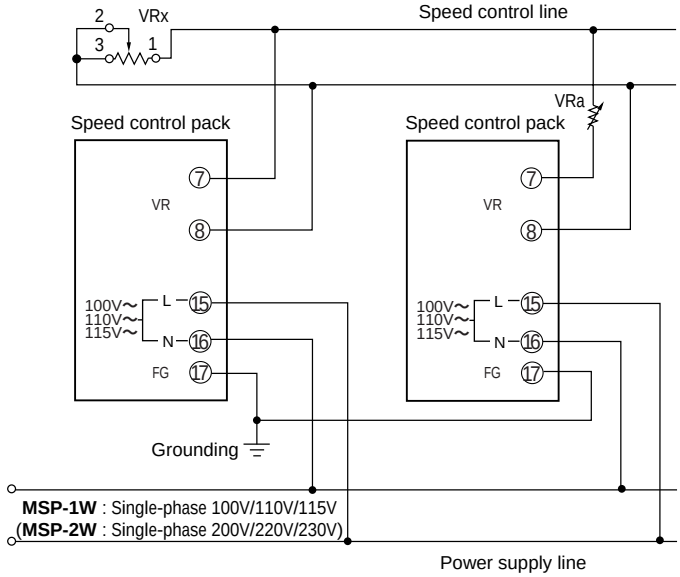


To control multiple motors with the same DC voltage signal, perform the connections as indicated in connection diagram at left. Always connect a 1k Ω 1/4W or greater resistor between terminals ⑦and ⑧ on each of the speed control packs to input correct speed control voltage.

When the number of motors to use is N, the current value of the DC power supply is N times as large as 10mA.

Thus, when two motors are used, current capacity should be at least 20mA.

(2) Control with a Signal Variable Resistor



As shown in the diagram at left, motors use common power supply and speed control lines, with speed set with potentiometer VRx.

Resistance for speed potentiometer VRx may be obtained as follows :

Resistance for N motors $VRx = \frac{20}{N}$ k Ω , N/4W

For Example : When two motors are used, resistance is

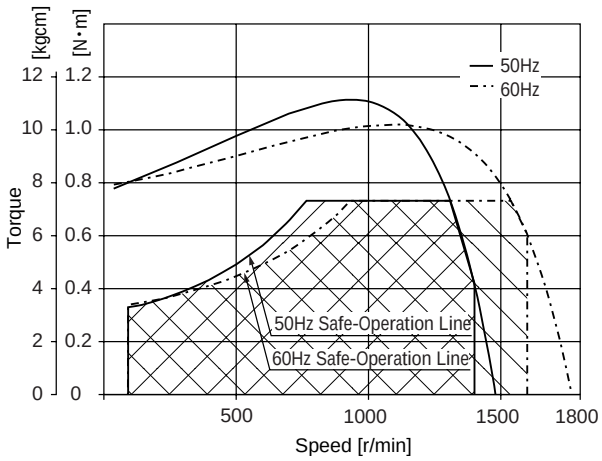
$VRx = \frac{20}{2}$ k Ω , 2/4W=10k Ω ,1/2W

Each motor rotates at roughly the same speed, but there may be some error in speed owing to differences in load or individual motor performance. To reduce the effects of such differences, add a variable resistance device VRa for making fine adjustments. Resistance in the VRa potentiometer should be 5〜10% of VRx resistance depending on the speed setting, and have a capacity of 1/4W.

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6. Characteristics

6.1 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 (In case of using the reversible motor, it is measured by 30 minute operation). 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℃(194 ℉), 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 may shorten its life.

6.2 Repeated Operation and Braking Cycle

Repeated motor operation and braking causes the motor's temperature to rise and limits the continuous usage time of both the motor and control pack.

Maximum motor output	Operation and braking cycle
6W～25W	2 seconds or longer (1 second of operation and 1 second stopped)
40W～90W	4 seconds or longer (2 second of operation and 2 second stopped)

6.3 Braking Current

When stopping the motor instantaneously, a large braking current is run through the winding, as shown in the table.

Make allowance for the braking currents shown in the table when choosing a breaker (or fuse) for the machinery in which the motor is installed.

AC100V/110V/115V

Type	Braking Current (Peak value) [A]
MSS206 type	1.3
MSS315 type	3.9
MSS425 type	6.9
MSS540 type	12.2
MSS560 type	22.5
MSS590 type	23.6

AC200V/220V/230V

Type	Braking Current (Peak value) [A]
MSS206 type	0.8
MSS315 type	2.1
MSS425 type	3.3
MSS540 type	6.7
MSS560 type	9.0
MSS590 type	13.6

7. Locked Rotor Burnout Protection of Motor

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

■ Thermal protection ("TP" "TP211" is stamped on the motor name plate)

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℃(266 ℉) ± 5℃(9 ℉)
Power is turned back on at 82℃(180 ℉) ± 15℃(27 ℉)

■ Impedance protection ("ZP" is stamped on the motor name plate)

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.

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8. Troubleshooting

When the motor is not running properly, try to find the problem in the following table . If you still cannot solve the problem, contact your nearest ORIENTAL MOTOR office.

Problem	What to Check	Response
Motor does not run	① Is the power supply connected correctly?	Connect the power supply and check to see that the POWER LED (green) is lit.
	② Is the signal power supply connected correctly?	Connect the DC24V power supply.
	③ Are the connector connections secure?	Insert connectors firmly all way in.
	④ Are the CW and CCW inputs on (low)?	Turn on (switch to low) the input for the desired direction of rotation.
	⑤ Is the speed potentiometer turned all the way in the counterclockwise direction?	Turn the speed potentiometer to the clockwise. (This applies to both internal and external speed potentiometer.)
	⑥ Is the DC power supply of the external DC voltage 0V?	Apply the external DC voltage.
	⑦ Have you selected the desired speed setting method?	Check the speed setting method.
	⑧ Is the correct voltage being supplied to the speed control pack?	Check the voltage as indicated in section “2.2 Checking the Product Name and Motor-Speed Control Pack Combination”.
	⑨ Is the load too large?	Check the load and use below rated torque.
	⑩ Do you have the right motor-speed control pack-capacitor combination?	Check the combination as indicated in section “2.2 Checking the Product Name and Motor-Speed Control Pack Combination”.
	⑪ Was the thermal protector activated?	Refer to section “7 : Locked Rotor Burnout Protection” .
	⑫ Is the provided capacitor connected as indicated in section “4 : Connecting”?	Connect properly as indicated in section “4 : Connecting” .
Speed does not change	① Have you selected the desired speed setting method?	Check the speed setting method.
Motor rotates in an opposite direction.	① Are you using a gearhead?	Some gearhead speed ratios will cause rotation in the opposite direction to the motor shaft.
	② Is a signal being input to terminal ③? (CW takes precedance)	Turn off (switch to high) the CW input.
	③ 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.
Starting is delayed	① Is the setting of the acceleration duration potenimeter other than “0”?	Set the acceleration time potentiometer to “0”.
Reversing is delayed	① Is the load inertia excessive?	Reversing can be delayed if the load inertia is high.
Stopping is delayd	① Is the setting of the deceleration duration potentiometer other than “0”?	Either turn off (switch to high) the SLOW DOWN input or set the deceleration time potentiometer to “0”.
	② Is the load inertia excessive?	Check the load inertia.
The motor becomes extraordinariy hot (motor case temperature exceeds 90℃(194 ℉))	① Is the correct voltage being supplied to the speed control pack?	Check the voltage as indicated in section “2.2 Checking the Product Name and Motor-Speed Control Pack Combination”.
	② Does the ambient temperature exceed the permissible range?	Reduce ambient temperature to below maximum ambient temperature rating.
	③ Do you have the right motor-speed control pack-capacitor combination?	Check the combination as indicated in section “2.2 Checking the Product Name and Motor-Speed Control Pack Combination”.
The power lamp does not go on	① Are both the AC power supply and DC power supply input?	Input both the AC power supply and DC power supply.
The motor makes a strange noise	① Are the motor and gearhead correctly fastened?	Refer to the gearhead operation manual.
	② Is the coupled gearhead the same pinion type as the motor shaft?	Check the combination as indicated in section “2.2 Checking the Product Name and Motor-Speed Control Pack Combination”.
The cooling fan dose not rotate	① Is the correct voltage being supplied to the speed control pack?	Check the voltage as indicated in section “2.2 Checking the Product Name and Motor-Speed Control Pack Combination”.
	② Have the motor and speed control pack become disconnected?	Insert connectors firmly all the way in.

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