



OPERATING MANUAL

AC Power Supply Input
Low-Power-Consumption & Variable-Speed Axial Flow Fans
EMR Series



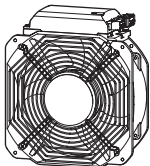
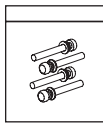
Thank you for purchasing an Oriental Motor product.
 This Operating Manual describes product handling procedures and safety precautions.
 • Please read it thoroughly to ensure safe operation.
 • Always keep the manual where it is readily available.

Only qualified and educated personnel should work with the product.
 The product described in this manual has been designed and manufactured to be incorporated in general industrial equipment. Do not use for any other purpose.
 Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

Use the product correctly after thoroughly reading the section "Safety precautions" on p.2.

Package contents

The package includes the items below. Report any missing or damaged items to the branch or sales office from which you purchased the product.

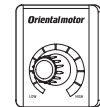
<input type="checkbox"/> Fan 	<input type="checkbox"/> Mounting screw set  Screw size : M5, 4 pcs
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OPERATING MANUAL (this manual)

External potentiometer (sold separately)

The rotation speed of the fan can be adjusted by connecting an external potentiometer.

Model: PAVR2-20K, etc.

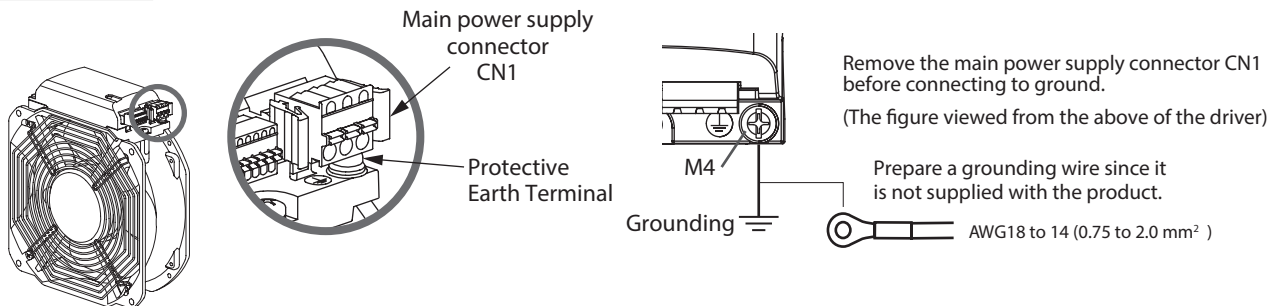


Refer to the operating manual of the external potentiometer for details.

Operates with ease

1 Connection

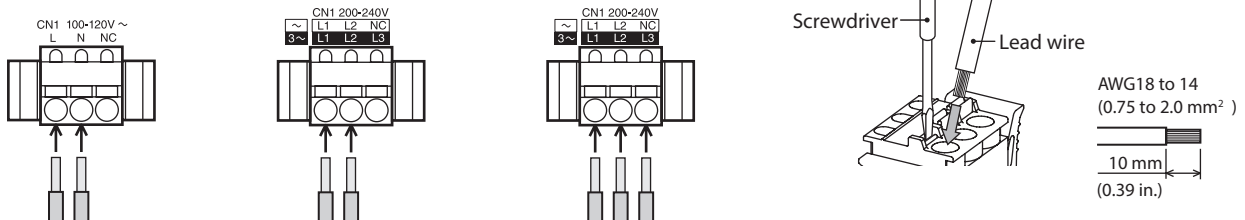
Make sure to connect the Protective Earth Terminal (⊕) directly to the grounding point to prevent possible danger of electric shock.



Main power supply connector CN1
 Protective Earth Terminal
 M4
 Grounding
 Remove the main power supply connector CN1 before connecting to ground.
 (The figure viewed from the above of the driver)
 Prepare a grounding wire since it is not supplied with the product.
 AWG18 to 14 (0.75 to 2.0 mm²)

Connect the power supply to the main power supply connector CN1.

- Single-phase 100-120 V
- Single-phase 200-240 V
- Three-phase 200-240 V



AWG18 to 14 (0.75 to 2.0 mm²)
 10 mm (0.39 in.)

2 Operation

When the power supply is turned on, the fan operates at the rated speed 3000 r/min.

At this time, the LED is lit in green (POWER).
 The rotation speed of the fan can be adjusted. Refer to "Operation" on p.6 for the setting method.

Note Do not perform the fan's frequently starting and stopping operations by turning the power supply on and off.

Refer to the respective pages for the details on this product.

Safety precautions

The precautions described below are intended to prevent danger or injury to the user and other personnel through safe, correct use of the product. Use the product only after carefully reading and fully understanding these instructions.

⚠ WARNING	Handling the product without observing the instructions that accompany a "WARNING" symbol may result in serious injury or death.
⚠ CAUTION	Handling the product without observing the instructions that accompany a "CAUTION" symbol may result in injury or property damage.
Note	The items under this heading contain important handling instructions that the user should observe to ensure safe use of the product.

[Description of graphic symbols]

⊘: Indicates "prohibited" actions that must not be performed.

⚠: Indicates "compulsory" actions that must be performed.

⚠ WARNING	
⊘	<ul style="list-style-type: none"> Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. Doing so may result in fire, electric shock or injury. Do not transport, install, connect or inspect the product while the power is supplied. Always turn the power off before carrying out these operations. Failure to do so may result in electric shock or injury. The terminals on the driver marked with ⚠ symbol indicate the presence of high voltage. Do not touch these terminals while the power is on. Doing so may result in fire or electric shock. Do not forcibly bend, pull or pinch the cable. Doing so may result in fire or electric shock. Do not touch the product when conducting insulation resistance measurement or dielectric strength test. Accidental contact may result in electric shock. Do not touch the connection terminals on the driver immediately (within 1 minute) after the power is turned off. Residual voltage may cause electric shock. Do not disassemble or modify the fan. 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.
⚠	<ul style="list-style-type: none"> 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 or injury. The fan is Class I equipment. When installing the fan, ground the Protective Earth Terminal. Failure to do so may result in electric shock. When the leakage current of fan exceeds 3.5 mA, ground the Protective Earth Terminal at the time of installation. Failure to do so may result in electric shock. Shut off the power to the fan in the event the overheat protection circuit is activated. Otherwise, the fan will start unexpectedly when released from the locked condition, causing bodily injury or equipment damage. Keep the input-power voltage within the specified range. Failure to do so may result in fire or electric shock. Be sure to observe the specified cable sizes. Use of unspecified cable sizes may result in fire. Connect and ground the product securely according to the wiring diagram. Failure to do so may result in fire or electric shock. Turn off the power in the event of a power failure. Otherwise, the fan will suddenly start when the power is restored, and this may cause injury or damage to equipment.

⚠ CAUTION	
⊘	<ul style="list-style-type: none"> Do not use the product beyond the specifications. Doing so may result in electric shock, injury or damage to equipment. Keep your fingers and objects out of the openings in the product. Failure to do so may result in injury. Do not touch the fan motor while operating or immediately after stopping. The surface of the fan motor is hot and may cause a skin burn(s). Do not lift the product by holding the power supply cable. Doing so may cause injury. Keep the area around the fan free of combustible materials. Failure to do so may result in fire or a skin burn(s). Do not leave anything around the fan that would obstruct ventilation. Doing so may result in damage to equipment. Do not operate the fan in a state where the finger guard is detached. If the fan is operated in a state where the finger guard is detached, it may result in injury to touch the rotating part (blade) of the fan.
⚠	<ul style="list-style-type: none"> Immediately when trouble has occurred, stop operation and turn off the power supply. Failure to do so may result in fire, electric shock or injury. Install the fan inside equipment for sure. Failure to do so may result in injury or damage to equipment.

⚠ CAUTION

- Be sure to ground the product to prevent it from being damaged by static electricity. Failure to do so may result in fire or damage to equipment.
- For the power supply of I/O signals, use a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock.
- The surface temperature of fan motor may exceed 70 °C (158 °F) even under normal operating conditions. If the operator is allowed to approach the fan that is operating, attach a warning label as shown in the figure in a conspicuous position. Failure to do so may result in a skin burn(s).
- Dispose the product correctly in accordance with laws and regulations, or instructions of local governments.



Warning label

Checking the product

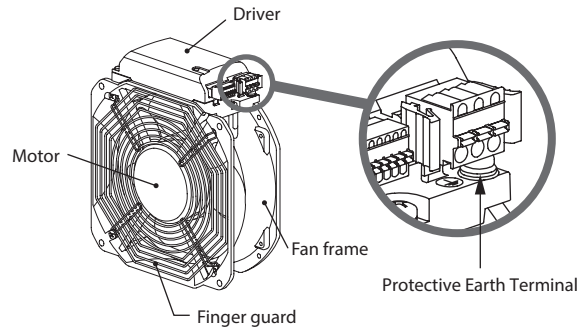
Verify the model number of the purchased product against the number shown on the package label.

Model

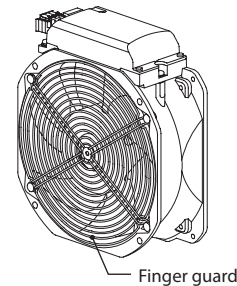
Power supply voltage	Model
Single-phase 100-120 V	EMR1865-A
Single-phase / Three-phase 200-240 V	EMR1865-C

Names and functions of parts

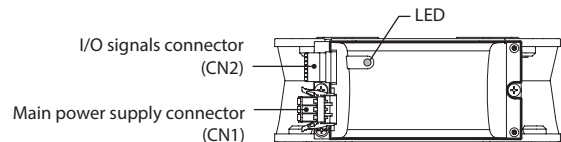
■ Discharge side



■ Intake side



■ Driver



Item	Mark	Description									
LED	POWER —	This LED is lit in green while the main power is input.									
	ALARM ····	It blinks in red when an alarm is generated.									
Main power supply connector (CN1)	<table border="1" style="font-size: small;"> <tr> <td>L</td> <td>N</td> <td>NC</td> </tr> <tr> <td>L1</td> <td>L2</td> <td>NC</td> </tr> <tr> <td>L1</td> <td>L2</td> <td>L3</td> </tr> </table>	L	N	NC	L1	L2	NC	L1	L2	L3	Connects the main power supply.
L	N	NC									
L1	L2	NC									
L1	L2	L3									
I/O signals connector (CN2)	I/O	Connects the I/O signals.									
Protective Earth Terminal	⊕	Connects a grounding wire.									

Installation

Installation conditions

Install the product in the following location that provides easy access for inspection.

- Inside an enclosure that is installed indoors
- Operating ambient temperature -25 to $+65$ °C (-13 to $+149$ °F) (non-freezing)
- Operating ambient humidity 85% (non-condensing)
- Area that is free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- Area not exposed to direct sun
- Area free of excessive amount of dust, iron particles or the like
- Area not subject to splashing water (rain, water droplets), oil (oil droplets) or other liquids
- Area not subject to continuous vibration or excessive shocks
- Area free of radioactive materials, magnetic fields or vacuum
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.).
When using near a switching circuit or high-frequency power supply, the induced current may flow inside the fan due to electromagnetic noise (conductive noise, radiative noise). If the induced current flows, the electric corrosion is caused in the bearings of the fan. As a result, it may generate the noise or shorten the service life of the products. Use the fan in the environment that the electromagnetic noise does not cause.

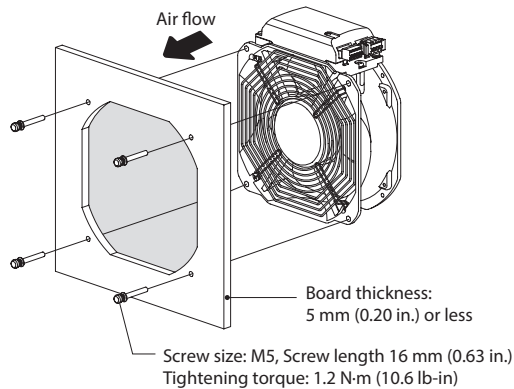
Installing fan

The fan frame is provided with tapped mounting holes (4×M5). Install the fan using the supplied mounting screws.

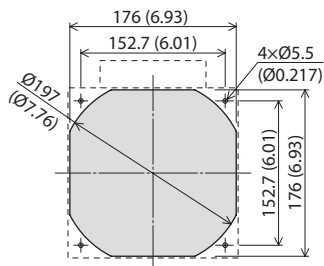
When the detached finger guard is mounted again, tighten the screws (M4) with the tightening torque 0.5 to 0.7 N·m (4.4 to 6.1 lb-in).

Note Check periodically whether any of tightened screws is loose. Retighten if the screw was loose.

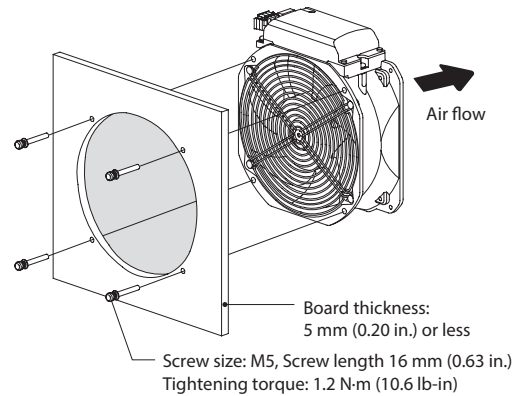
Discharge side



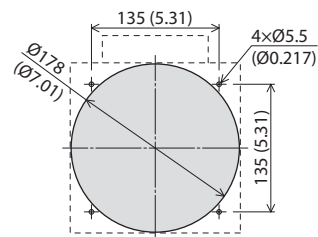
Panel cut-out [unit: mm (in.)]



Intake side

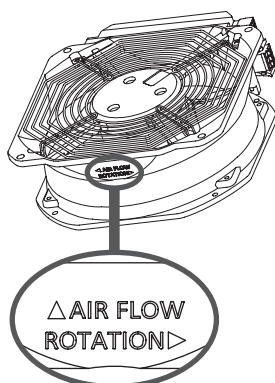


Panel cut-out [unit: mm (in.)]



Air flow, direction of blade rotation

For the air flow and the direction of blade rotation, check the indication on the fan frame.



Connection

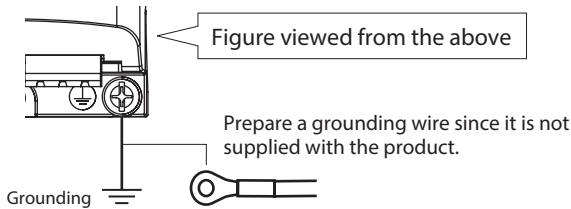
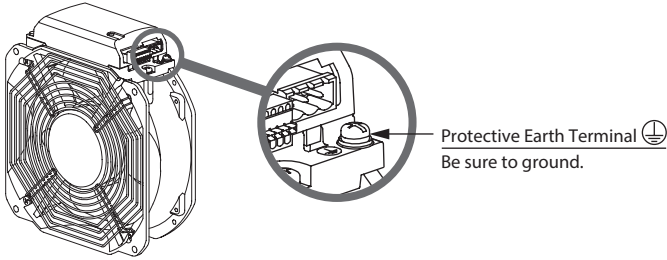
Grounding

Make sure the product is grounded to prevent the possible electric shock.

Note

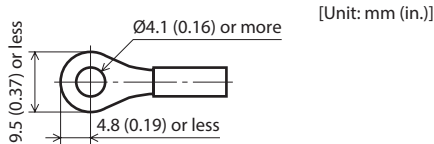
- Be sure to ground the product. Failure to do so may result in electric shock or damage to the product. Static electricity may cause damage to the product if the Protective Earth Terminals are not grounded.
- Since the leakage current of the **EMR1865-C** exceeds 3.5 mA, ground the Protective Earth Terminal when installing. Failure to do so may result in electric shock.

Remove the main power supply connector CN1 before grounding the Protective Earth Terminal ⊕.
Using this Protective Earth Terminal, connect to ground near the fan.



Ground terminal

- Applicable crimp terminal: Round crimp terminal with insulation cover
- Thread size of terminal: M4
- Tightening torque: 1.2 N·m (10.6 lb-in)
- Applicable lead wire: AWG18 to 14 (0.75 to 2.0 mm²)

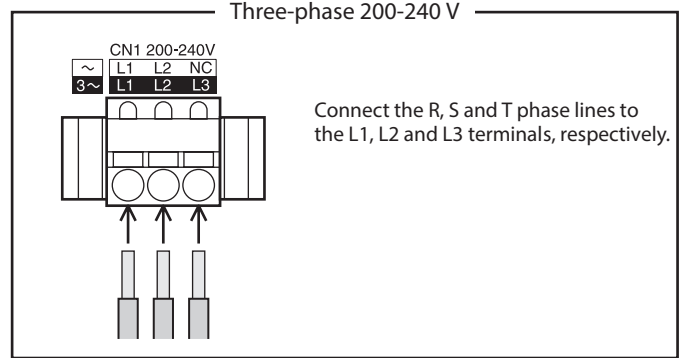
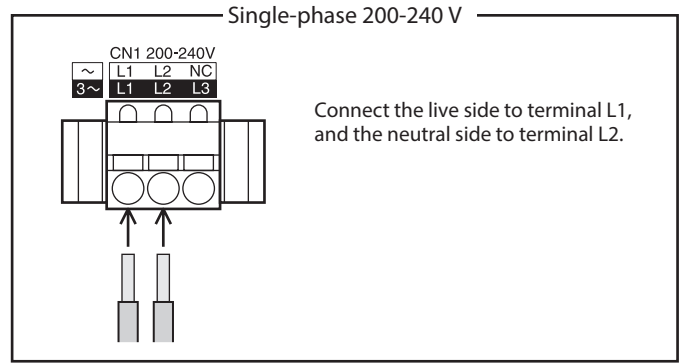
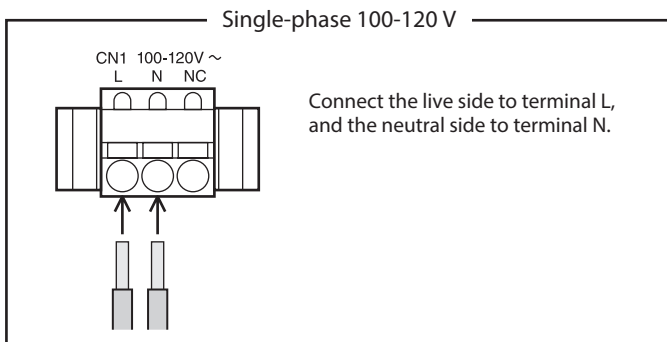


Connecting the power supply (CN1)

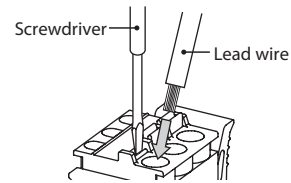
Note

- Check the power-supply voltage specifications of the fan before applying the voltage. If the voltage exceeding the rated range is applied, the fan may be damaged.
- Securely connect so that the lead wire which was inserted to the connector does not come off. Failure to do so may result in electric shock or damage to the product.

Connect the power supply to the main power supply connector CN1.
The connecting method varies depending on the power-supply voltage specifications of the fan.



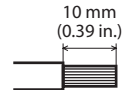
Connecting method



Connector model: FKC2,5/3-ST-5,08-RF
(PHOENIX CONTACT GmbH & Co. KG)

Applicable lead wire

- Lead wire size: AWG18 to 14 (0.75 to 2.0 mm²)
- Conductive material: Use only copper wire.



Crimp terminals can also be used to connect.
If crimp terminals are used, select the following terminals.

Manufacturer: PHOENIX CONTACT GmbH & Co. KG

Model: AI 0,75-10 [AWG18 (0.75 mm²)]*

AI 1-10 [AWG18 (1.0 mm²)]*

AI 1,5-10 [AWG16 (1.5 mm²)]*

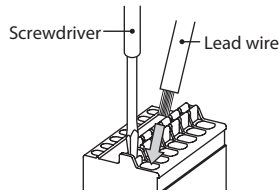
AI 2,5-10 [AWG14 (2.5 mm²)]*

* This is specifications of the manufacturer.

Connecting the I/O signals (CN2)

Connect the input signals and output signals to the I/O signal connector CN2.

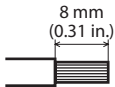
■ Connecting method



Model: FK-MC0,5/7-ST-2,5
(PHOENIX CONTACT GmbH & Co. KG)

Applicable lead wire

- Lead wire size: AWG26 to 20 (0.14 to 0.5 mm²)



Crimp terminals can also be used to connect.
If crimp terminals are used, select the following terminals.

Manufacturer: PHOENIX CONTACT GmbH & Co. KG

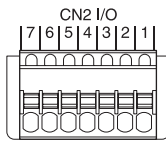
Model: A 0,25-7 [AWG24 (0.25 mm²)]*

A 0,34-7 [AWG22 (0.34 mm²)]*

A 0,5-8 [AWG20 (0.5 mm²)]*

* This is specifications of the manufacturer.

■ CN2 pin assignment

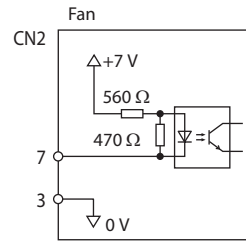


Pin No.	Signal name	Function	Description
7	INT/EXT	Rotation speed setting input	The fan speed can be switched between the rated speed 3000 r/min and the rotation speed set by the external speed setting input.
6	VH	External speed setting input	Connects when setting the rotation speed externally. Refer to p.6 for details.
5	VM		
4	VL		
3	COM	Input signal common (0 V)	Input signal common
2	ALARM+	Alarm output	These outputs are turned OFF when an alarm is generated: Photo MOS relay opens. (Normally closed)
1	ALARM-		

Pin No.3 and No.4 are connected inside the driver.

■ Input signal circuit

Photocouplers are used for receiving the input signals.



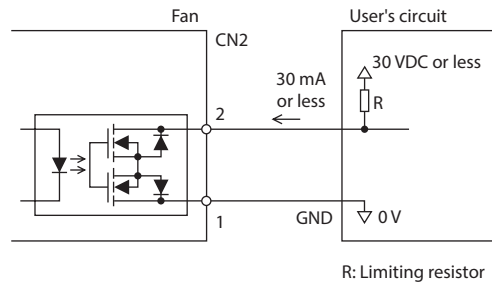
■ Alarm output

Output signals are output by the Photo MOS relay.

Output signal specifications

- Output status Normal operation: Output ON (Closed)
Alarm output: Output OFF (Open)
- Maximum applied voltage: 30 VDC
- Maximum inflow current: 30 mA
- ON voltage: 0.1 DCV max.

Output signal circuit



R: Limiting resistor



- Connect a current-limiting resistor R according to the power supply voltage if the current flowing through the output signal exceeds 30 mA.
- For the low-speed alarm, the alarm function becomes effective within 10 seconds after the fan starts.

Operation

Using this product, the following operations can be performed. The fan rotates when the main power supply is turned on.

Note Do not perform the fan's frequently starting and stopping operations by turning the power supply on and off.

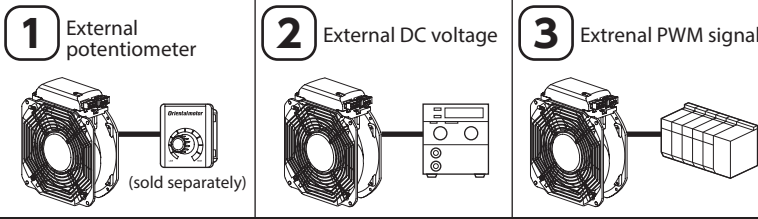
Rotation speed setting range: 500 to 3500 r/min

Rated speed: 3000 r/min

Constant speed operation

Refer to "Operates with ease" on p.1.

Variable speed operation



Two-speed operation

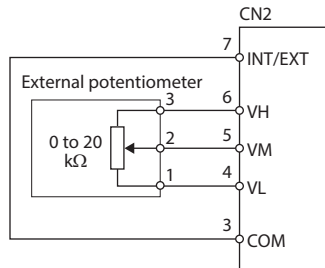
4 The fan can be operated at two speeds by switching the INT/EXT (rotation speed setting input).

For the variable speed operation, when Pin No.3 and No.7 of CN2 are shorted, the rotation speed, which is set externally, becomes effective (external speed setting).

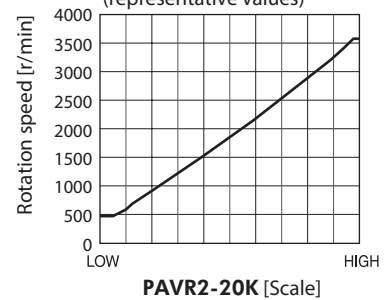
1 Adjustment using the external potentiometer

The rotation speed can be set using an accessory external potentiometer (sold separately). The fan rotates at the lowest speed when the external potentiometer is set to LOW.

• Connection diagram



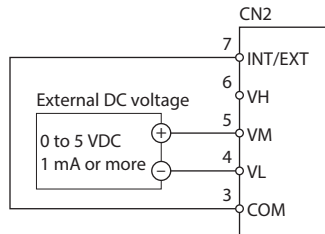
External potentiometer - Rotation speed characteristics (representative values)



2 Adjustment using the external DC voltage

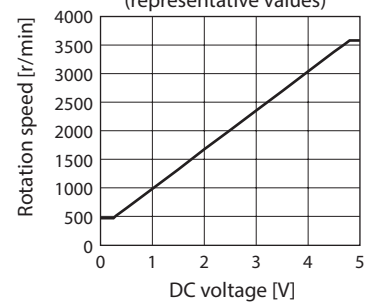
The rotation speed can be set by using an external DC voltage.

• Connection diagram



Input impedance: 47 kΩ (between VM - VL)

External DC voltage - Rotation speed characteristics (representative values)



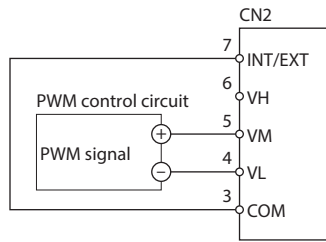
Note For the external DC voltage, use a DC power supply with reinforced insulation on its primary and secondary sides.

3

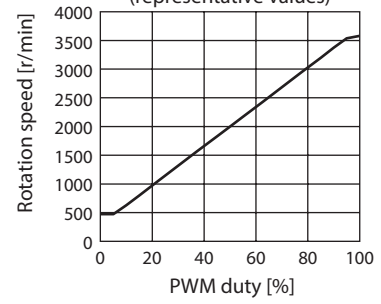
Adjustment using the external PWM signal

The rotation speed can be set by using an external PWM signal. The rotation speed varies depending on the duty of input pulse signal.

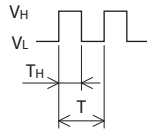
• Connection diagram



PWM duty - Rotation speed characteristics (representative values)



• Input signal specifications



$$\text{PWM duty (\%)} = \frac{T_H}{T} \times 100$$

$$\text{PWM frequency 25 (kHz)} = \frac{1}{T}$$

$$V_H = 4.75 \text{ to } 5.25 \text{ V} \quad V_L = 0 \text{ to } 0.4 \text{ V}$$

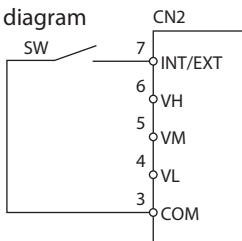
4

Two-speed operation

The fan can be operated at two speeds by switching ON-OFF status of the switch (SW).

[Changing the rotation speed by using the SW only]

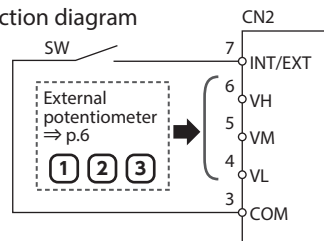
• Connection diagram



SW	Rotation speed
OFF	3000 r/min
ON	500 r/min

[Changing the rotation speed to the external set speed]

• Connection diagram



SW	Rotation speed
OFF	3000 r/min
ON	External speed setting

As shown in the figure to the left, the fan can be operated by switching the rotation speed between 3000 r/min and the external set speed.

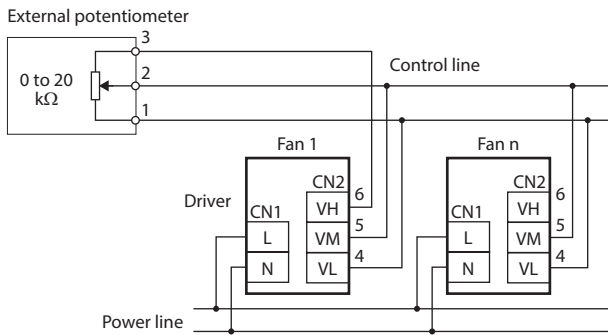
Multi-fan control

Two or more fans can be operated at the same speed using a single external potentiometer, external DC voltage, or external PWM signal. To enable the external speed setting, connect the PIN No.3 and No.7 in the CN2 of each fan.

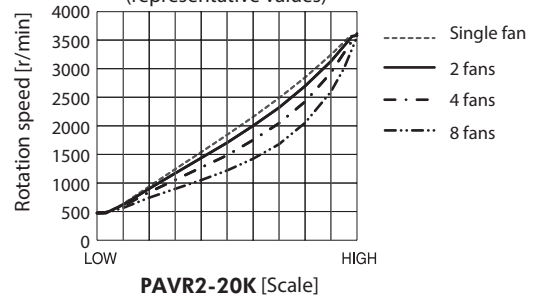
■ Adjusting the rotation speed using the external potentiometer

Connect the drivers as shown in the figure below.

When performing multi-fan control using the external potentiometer, the number of fans should not exceed 8 units.



External potentiometer - Rotation speed characteristics (representative values)

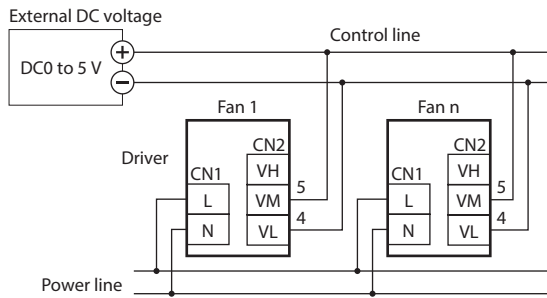


■ Adjusting the rotation speed using the external DC voltage or external PWM signal

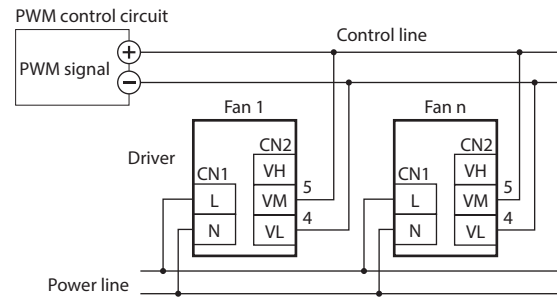
Connect the drivers as shown in the figure below.

The number of connected units may limit depending on the current capacity of the external DC power supply or external PWM signal.

● Using external DC voltage



● Using external PWM signal



Calculation method of current capacity (I) for when the number of fans connected is n

Current capacity (I) = 1 × n (mA)

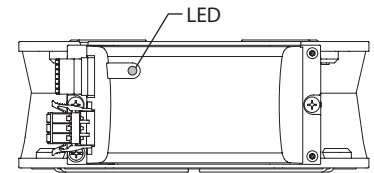
Example: If two fans are used

Current capacity (I) = 1 × 2 (mA)

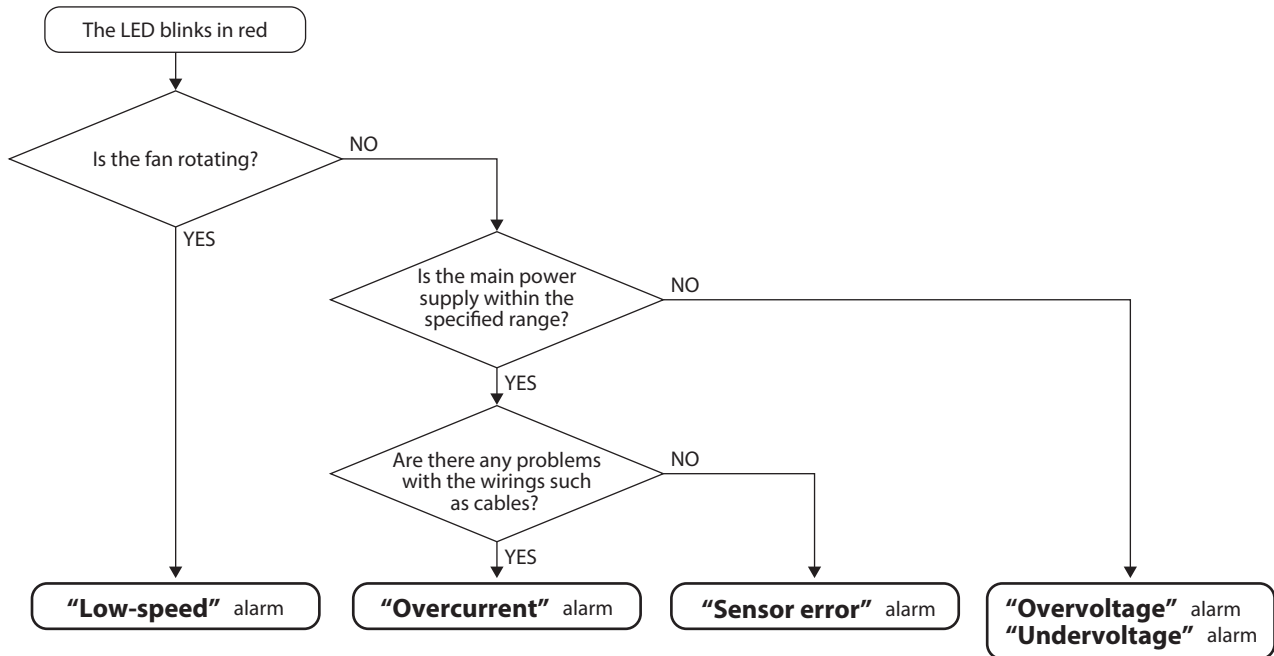
Alarms

This product is provided with the alarm function to monitor the status of the fan. If an error occurred in the fan, the LED blinks in red (ALARM) and the alarm output is turned OFF. (Normally closed)
The fan resumes operation when the cause of the alarm is removed and the error state is released.
(Refer to the list of alarms)

When the LED blinks and the fan is stopped, ensure the safety before resolving the cause.



Check the following contents when an alarm is generated



■ Alarm list

Alarm type	Cause	Remedial action	Fan operation when an alarm is generated
Low-speed	The rotation speed has decreased below 70% of the set speed.	Make sure that no foreign object that would obstruct rotation of the fan is attached.	Continue to operate
Overcurrent	Excessive current has flown through the driver due to ground fault, etc.	Check whether the connection between the driver and fan has damaged. If the alarm cannot be cleared by cycling the power, turn off the power, and contact the nearest Oriental Motor sales office.	Stop
Sensor error	The cable connection between the fan and driver has been come off during operation. Or, the sensor wire inside the cable has been disconnected.	Turn off the power, and then check the connection between the driver and fan.	Stop*
Overvoltage	The main power supply has exceeded the specified value. (100-120 VAC input: 133 VAC, 200-240 VAC input: 265 VAC)	Check the main power supply voltage.	
Undervoltage	The voltage of the main power supply dropped below the specified value. (100-120 VAC input: 80 VAC, 200-240 VAC input: 160 VAC)	Check the main power supply voltage.	

* When the cause of the alarm is removed and the fan returns to a normal state, the fan resumes operation automatically.

Overheat protection for locked condition

This fan is equipped with a built-in overheat protection circuit. Since this circuit automatically controls the current flow to the windings when a locked condition is detected, it prevents the fan from burning out. The fan resumes operation automatically as soon as it is released from the locked condition. Turn off the power in the event of inspections.

Inspection

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

Note The driver uses semiconductor elements, so be extremely careful when handling them. Electrostatic discharge can damage the driver.

■ Inspection item

- Are any of the fan mounting screws loose?
- Are any of the finger guard mounting screws loose?
- Are there any abnormal noises in the fan bearings (ball bearings)?
- Are any of the driver connection parts loose?
- Are there any strange smells or appearances in the driver unit?

General specifications

Operation environment	Ambient temperature	-25 to +65 °C (-13 to +149 °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 or dust. Cannot be used in radioactive materials, magnetic field, vacuum or other special environment.
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 or dust. Cannot be used in radioactive materials, magnetic field, vacuum or other special environment.
Degree of protection		IP2× (EN Standards)

Regulations and standards

■ UL Standards, CSA Standards

This product is recognized by UL under the UL and CSA Standards. Thermal class UL/CSA Standards: 105(A)

■ CE Marking

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

■ Low Voltage Directive

Installation conditions

Overvoltage category: II, Pollution degree: 2, Degree of protection: IP2X, Protection against electric shock: Class I

- Isolate the power cable and signal cable with double insulation.

■ EMC Directive

Refer to "Conformity to EMC" on p.11 for details about conformity.

■ RoHS Directive

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

■ Republic of Korea, Radio Waves Act

This product is affixed with the KC Mark under the Radio Waves Act, the Republic of Korea.

Conformity to EMC

This product has been designed and manufactured to be incorporated in equipment. The EMC Directive requires that your mechanical equipment in which the product is installed satisfies the applicable requirements. The installation/wiring methods of the fan explained here represent the basic methods that are effective in helping your mechanical equipment conform to the EMC Directive. Oriental Motor conducts EMC testing on its motors and speed controllers in accordance with "Example of installation and wiring". The user is responsible for ensuring the machine's compliance with the EMC Directive, 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 a mains filter

Install a mains filter which the customer provides, in the power line in order to prevent the noise generated within the driver from propagating outside via the AC input line. For mains filters, use the products as shown in the chart, or an equivalent.

Manufacturer	Single-phase 100-120 VAC, single-phase 200-240 VAC	Three-phase 200-240 VAC
SOSHIN ELECTRIC CO., LTD	HF2010A-UPF, NF2010A-UP	NFU3010C-Z1
Schaffner EMC	FN2070-10-06	FN3025HP-10-71

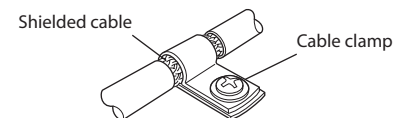
- Overvoltage category II applies to mains filters.
- Install the mains filter as close to the driver as possible.
- Use cable clamps and other means to secure the input and output cables firmly to the surface of the enclosure.
- Connect the ground terminal of the mains filter to the grounding point, using as thick and short a wire as possible.
- Do not place the AC input cable (AWG18 to 14: 0.75 to 2.0 mm²) parallel with the mains-filter output cable (AWG18 to 14: 0.75 to 2.0 mm²). 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.

■ How to ground

Cables used for grounding the fan, mains filter, and power supply cable (shielded cable) must be as thick and short distance as possible so that no potential difference is generated among the grounding points. Choose a large, thick and uniformly conductive surface for the grounding point. Refer to p.4 for the detailed grounding method.

■ Wiring the power supply cable

Use a shielded cable of AWG18 to 14 (0.75 to 2.0 mm²) for the power supply cable, and keep it as short as possible. Strip a part of the shielded cable and ground the stripped part using a metal cable clamp that contacts the stripped cable around its entire circumference, or use a drain wire to make the ground connection. Connect both ends (mains filter side and power supply side) of the shielded cable to the grounding points so that no potential difference is generated between grounds.



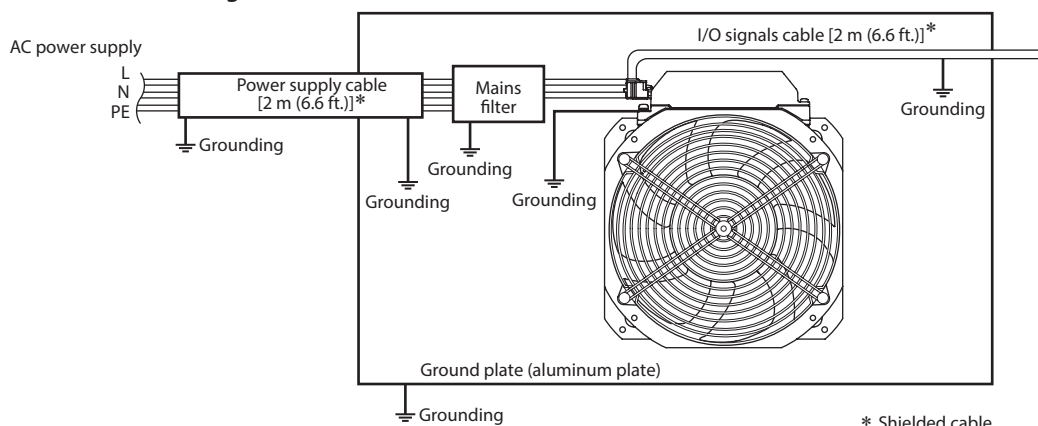
■ Wiring the I/O signals cable

Use a shielded cable of AWG26 to 20 (0.14 to 0.5 mm²) for the I/O signals cable, and keep the wiring distance as short as possible [less than 2 m (6.6 ft.)]. Refer to "Wiring the power supply cable" for how to ground the shielded cable.

■ Notes about installation and wiring

- Connect the fan 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 product, use mains filters or CR circuits to suppress surges generated by them.
- Keep cables as short as possible without coiling and bundling extra lengths.
- Wire the power lines such as the power cable away from the signal cables by providing a minimum clearance of 100 mm (3.94 in.) between them. If they must cross, do so at a right angle. Place the AC input cable and output cable of a mains filter separately from each other.

■ Example of installation and wiring



■ Precautions about static electricity

Static electricity may cause the driver to malfunction or suffer damaged. Be sure to ground the product to prevent it from being damaged by static electricity. Do not approach or touch the product while the power is on.

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