Oriental motor

HF-3191-3

EC Fans

EMR Series

OPERATING MANUAL

Introduction

Safety precautions

Preparation

Installation

Connection and operation

Alarms

Inspection and maintenance

Specifications

Regulations and standards

Thank you for purchasing an Oriental Motor product.
This operating manual describes product handling procedures and safety precautions.

- Please read the manual thoroughly to ensure safe operation.
- Always keep the manual where it is readily available.

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1 Introduction

■ Before using the product

Only qualified personnel of electrical and mechanical engineering should work with the product.
Use the product correctly after thoroughly reading the section "2 Safety precautions." In addition, be sure to observe the contents described in warning, caution, and note in this manual.
The product described in this manual is designed and manufactured to be incorporated into general industrial equipment. Do not use it for any other purpose. Oriental Motor Co., Ltd. is not responsible for any compensation for damage caused through failure to observe this warning.

2 Safety precautions

The precautions described below are intended to ensure the safe and proper use of the product and to prevent the user and other personnel from exposure to the risk of injury. 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, in areas subjected to splashing water, or near combustible materials. Doing so may result in fire, electric shock, or injury.
- Do not use the product in an environment where it is exposed to water, oil, solvents, chemicals, or other liquids, or in a space where it is volatile. The resin part (blades) is damaged, resulting in injury or damage to equipment.
- Do not transport, install, connect, or inspect the product while the power is supplied. Always turn off the power before carrying out these operations. This may cause electric shock or injury.
- Assign qualified and educated personnel to the task of installing, connecting, operating, and inspecting/ troubleshooting the product. Handling by unqualified and uneducated personnel may result in fire, electric shock, or injury.

Installation

- Do not forcibly bend, pull, or pinch the lead wire. Doing so may result in fire or electric shock.

Connection

- Do not touch the product when conducting the insulation resistance measurement or dielectric strength test. Accidental contact may result in electric shock.
- The fan is Class Ⅰ equipment. When installing it, ground the Protective Earth Terminal. Failure to do so may result in electric shock.
- Keep the input voltage of the power supply within the rated range. Failure to do so may result in fire, electric shock, or damage to equipment.
- Securely connect and ground in accordance with the connection diagram. Failure to do so may result in fire or electric shock.
- 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.

Operation

- Do not use the product beyond the specifications. Doing so may result in electric shock, injury, or damage to equipment.
- Do not touch the power lead wires after the power supply is turned off (for a period of 30 seconds). Residual voltage may cause electric shock.
- If the blades are locked due to overload, the lock-protection circuit will be activated to temporarily limit the power applied to the windings. Shut off the power to the fan in the event the lock-protection circuit is activated. Otherwise, the fan will start unexpectedly when released from the locked condition. This may cause injury or damage to equipment.
- 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.
- Immediately stop operation and disconnect the power supply if an abnormality has occurred. Failure to do so may result in fire, electrical shock, or injury.

Repair, disassembly, and modification

- Do not disassemble or modify the fan. Doing so may result in electric shock or injury.

⚠ CAUTION

General

- Keep your fingers and objects out of the openings in the fan. This may cause injury.

Installation

- Do not lift the fan by holding the rotating part (blades) or lead wires of the fan. Doing so may result in injury.
- Do not leave anything around the fan that would obstruct ventilation. Doing so may result in damage to equipment.
- Install the fan securely in an enclosure with excellent vibration resistance.

Operation

- After the power supply is turned on, the rotating part (blades) will temporarily stop in the process of motor excitation, which is normal operation. Do not touch the rotating part (blades) as this may cause injury.
- Do not touch the rotating part (blades) while operating. Doing so may result in injury. The use of the finger guard is recommended to ensure protection.
- Do not touch the motor section during operation or immediately after stopping. The surface of the motor section is hot and touching it may cause a skin burn(s).
- Turn off the power in the event of a power failure. Otherwise, the fan will start unexpectedly when the power is restored. This may cause injury or damage to equipment.
- The surface temperature of the motor section may exceed 70 °C (158 °F) even when the fan is rotating under normal operating conditions. If the operator is allowed to approach it during operation, affix a warning label as shown in the figure on a conspicuous position. The surface is hot, and this may cause a skin burn(s).

Warning label

3 Preparation

This chapter explains the items and contents to be checked.

3-1 Checking the product

Verify that the items listed below are included.
Report any missing or damaged items to the branch or sales office from which you purchased the product.

- ☐ Fan ..... 1 unit
- ☐ Instructions and Precautions for Safe Use ..... 1 copy

3-2 How to identify the product model

Check the model name of the product against that shown on the nameplate.

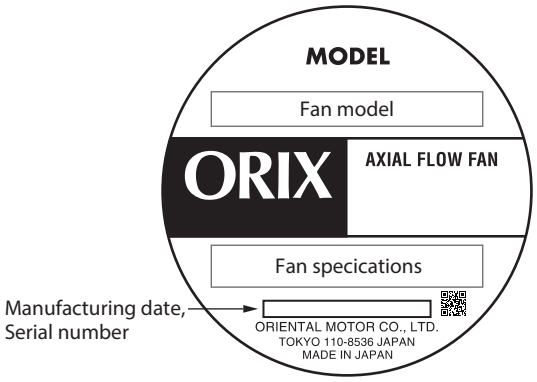
EMR	**20**	**90**	**V**	**M**	**H**	**- A**
1	2	3	4	5	6	7

1	Series name	**EMR**: **EMR** Series
2	Frame size	**20**: 200 mm (7.87 in.)
3	Frame thickness	**90**: 90 mm (3.54 in.)
4	Variable speed	**V**: Variable speed Blank: No function
5	Additional function	**M**: Low-speed alarm Blank: No additional function
6	Speed type	**H**: High speed Blank: Standard speed
7	Power supply voltage	**A**: Single-phase 100-120 VAC

Function	Type	Model name
Fan with low-speed alarm	Standard speed	**EMR2090M-A**
	High speed	**EMR2090MH-A**
	Variable speed	**EMR2090VMH-A**
–	Standard speed	**EMR2090-A**
	High speed	**EMR2090H-A**

3-3 Information about nameplate

The figure shows an example.



4 Installation

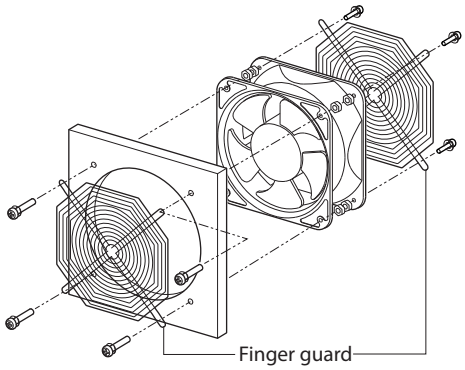
4-1 Installation location

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

- Inside an enclosure installed indoors
- Operating ambient temperature (non-freezing, non-condensing)
  Standard speed type: –20 to +60 °C [–4 to +140 °F]
  High speed type, variable speed type: –20 to +55 °C [–4 to +131 °F]
- Operating ambient humidity: 85 % or less (non-condensing)
- Area not subject to continuous vibration or excessive shocks
- Area free of radioactive materials, magnetic fields, or vacuum
- Area not exposed to direct sun
- Area free of dust, iron particles, or the like
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
  When the fan is used near a switching circuit or high-frequency power supply, the induced current may flow inside the fan due to electromagnetic noise (conductive noise, radiation 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 an environment that does not cause electromagnetic noise.

4-2 Installation method

- Install the fan on a flat metal plate with sufficient strength.
- Drill mounting holes in the equipment being used and secure the fan with screws (not included).
  Hexagon socket head cap screw Screw size: M5 Tightening torque: 1.2 N·m
- For directions of the air flow and blades rotation, see the arrow indicated on the side of the fan frame.
- Finger guards that can prevent fingers and foreign particles from entering are available as accessories (sold separately). When using, install as shown in the figure.



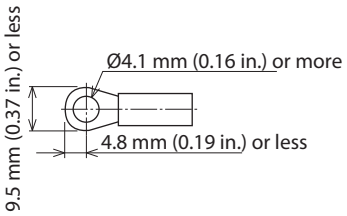
5 Connection and operation

Insulate all the wire connections, such as the fan lead wires and the connection part of the power supply.
The fan starts rotating when the power supply is turned on.

5-1 Connecting the Protective Earth Terminal

Use the Protective Earth Terminal ⏚ of the fan to ground.

Applicable crimp terminal: Ring crimp terminal with insulation cover
Terminal screw size: M4
Tightening torque: 1.0 to 1.3 N·m (8.8 to 11.5 lb-in)
Applicable lead wire: AWG18 (0.75 mm^2) or thicker



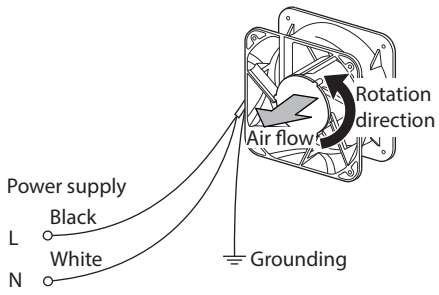
5-2 Operation

When the connection is made as shown in the figure to turn on the power supply, the fan starts rotating.
To prevent the risk of electric shock, do not turn on the power supply until the wiring has been completed.

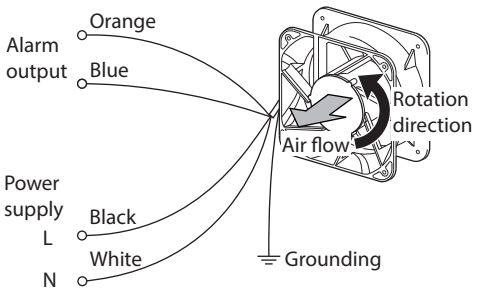
■ Connection diagram

Power lead wire size: AWG 20 (0.5 mm^2)
Alarm lead wire size: AWG 24 (0.2 mm^2)

- **EMR2090-A**, **EMR2090H-A**



- **EMR2090M-A**, **EMR2090MH-A**



Note After the power supply is turned on, the rotating part (blades) will temporarily stop in the process of motor excitation, which is normal operation. Do not touch the rotating part (blades) as this may cause injury.

5-3 Variable speed operation (variable speed type)

The speed can be changed using an external PWM signal.

■ Speed range

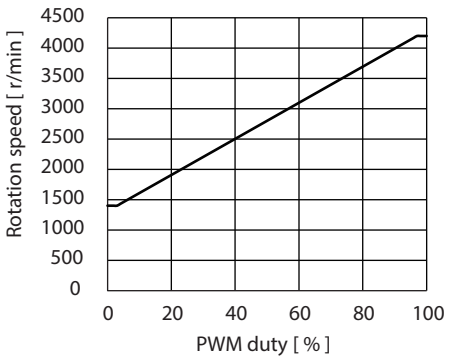
- **Minimum speed: 1400 r/min**

  Fixed at 1400 r/min when the PWM duty cycle is 3 % or less.

- **Maximum speed: 4200 r/min**

  Fixed at 4200 r/min when the PWM duty cycle is 97 % or more.

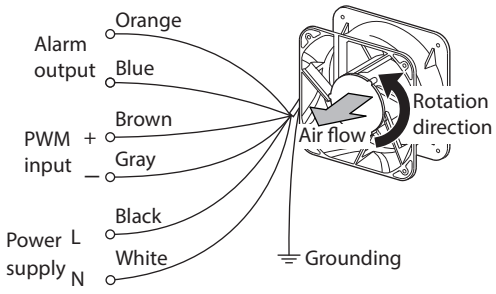
PWM duty - Rotation speed characteristics
(representative values)



■ Connection diagram

Power lead wire size: AWG 20 (0.5 mm^2)
Alarm lead wire size,
PWM lead wire size: AWG 24 (0.2 mm^2)

- **EMR2090VMH-A**



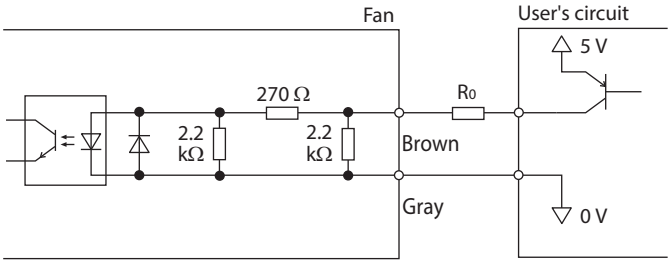
■ PWM input signal circuit

The fan speed can be adjusted by changing the duty cycle of the PWM signal.

- **Input specifications**

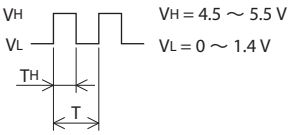
  Input frequency: 25 kHz
  Input current: 7 to 20 mA

- Connection example



R0: Limiting resistor

- Specifications of the input signal



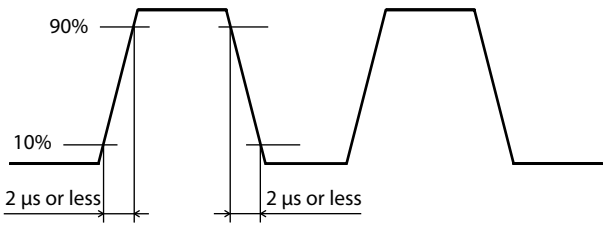
$$\text{PWM duty cycle (\%)} = \frac{T_H}{T} \times 100$$

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

- **PWM signal**

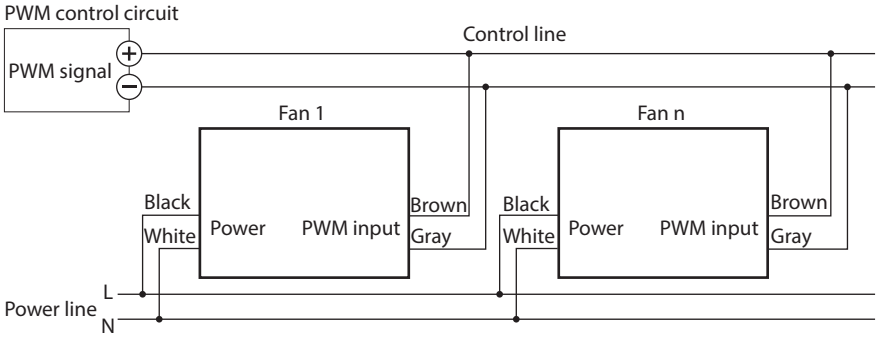
  Input the pulse as shown in the figure.
  The figure shows the voltage level of the pulse signal.

  Continued ON state: PWM duty cycle 100 %
  Continued OFF state: PWM duty cycle 0 %



■ Multi-fan control

A single external PWM signal can be used to operate multiple fans at the same speed. The number of connected units may limit depending on the current capacity of the external PWM signal. Connect as shown in the figure.

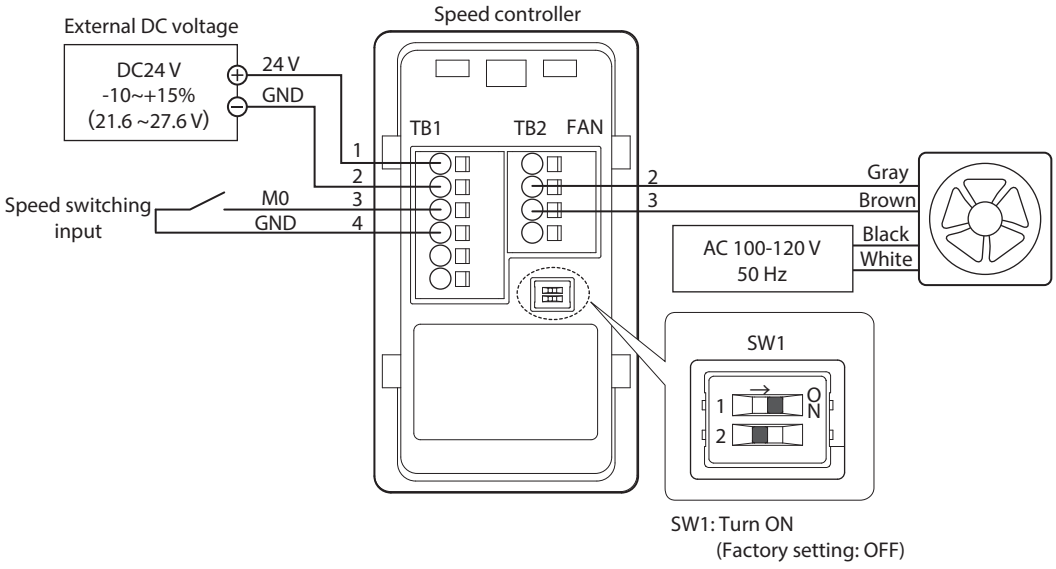


Method of calculating the current capacity (I) of the external PWM signal
Current capacity (I) = 11 (mA) × n (number of units)

Example: When two fans are connected
Current capacity (I) = 11 (mA) × 2 (units)
The current capacity (I) is calculated to be 22 mA or more.

■ Connection example using the FSC-24 speed controller

Speed controller: The maximum extension distance between the **FSC-24** and the fan is 2 m (6.6 ft.).
To operate the EC fan using the **FSC-24**, it is necessary to switch the "function select switch" on the rear panel.
Up to two fans can be operated in parallel with a single unit of the **FSC-24**.
Refer to the operating manual of the **FSC-24** for the speed switching input.



5-4 Alarm output

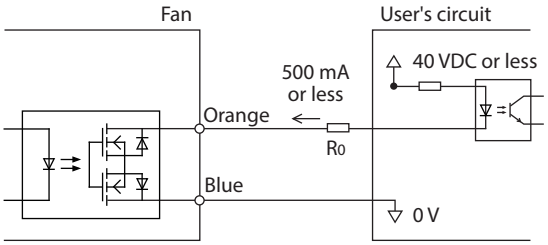
The output signal is the photo MOS relay output.

■ Output specifications

- Output status: When a fan is rotating normally, the alarm signal output is in an ON (closed) state. When an alarm is generated, the alarm signal output is in an OFF (open) state.
- Maximum applied voltage: 40 VDC or less
- Maximum inflow current: 500 mA or less
- On-state voltage: 0.1 V or less

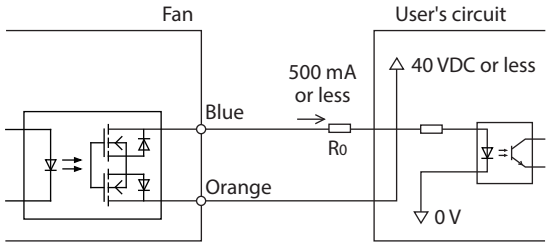
■ Output signal circuit

● Sink output



R0: Limiting resistor

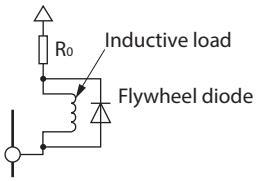
● Source output



R0: Limiting resistor

Note

- Connect a current-limiting resistor R0 according to the power supply voltage so that the current flowing through the output signal does not exceed 500 mA.
- The alarm function of the low-speed alarm is enabled within ten seconds after the fan starts rotating.
- When a relay (inductive load) is connected, it is necessary to take a control measure for the fly-back voltage against the relay by connecting a diode. Or use a relay with built-in flywheel diode.



5-5 Burning protection for locked condition

This fan is equipped with a built-in burnout prevention 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 when inspecting.

5-6 Compliance with EMC Directive/Regulations

This product is designed and manufactured as a component to be incorporated into equipment.
Without effective measures to suppress Electromagnetic Interference (EMI) caused by the product in the surrounding control system equipment or Electromagnetic Susceptibility (EMS) generated by the product, the function of your equipment may be seriously affected.
Oriental Motor's products are self-composed declaration in accordance with the conditions of "installation and wiring methods for EMC Directive/Regulations" described in the operating manual. The results of EMC testing of the equipment will vary depending on the type, layout, wiring method, etc. of the parts and components used.
Verify compliance with the EMC Directive/Regulations in a condition where all parts and components, including this product, are assembled into the equipment.

⚠ 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 an AC line filter

Install an AC line filter that the customer provides in the AC input line in order to prevent the noise generated inside the fan from propagating to the outside via the power line. For an AC line filter, use the products as shown in the table, or an equivalent.

Manufacturer	Single-phase 100-120 VAC
Soshin Electric Co., Ltd.	HF2010A-UPF, NF2010A-UP
Schaffner EMC	FN2070-10-06

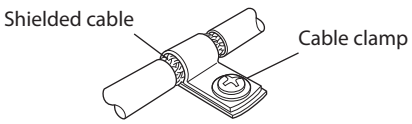
- Overvoltage category II applies to AC line filters.
- Install the AC line filter as close to the fan as possible.
- Use cable clamps and other means to secure the input and output cables firmly to the surface of the enclosure.
- Connect the ground terminal of the AC line filter to the grounding point using the thickest, shortest possible wire.
- Do not wire the AC input cable (AWG18 to 14: 0.75 to 2.0 mm^2) in parallel with the output lead wire from the AC line filter. Parallel wiring may reduce the effectiveness of the AC line filter because the internal noise of the enclosure is coupled directly to the power supply cable via stray capacitance.

■ Grounding method

Use the thickest possible wires and the shortest distance to ground the fan and the power supply cable (shielded cable) so that there is no potential difference between the grounding points. Choose a large, thick, and uniformly conductive surface for the grounding point.

■ Wiring the power supply cable

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 of the AC line filter side and the power supply side of the shielded cable to the grounding points so that there is no potential difference between the grounds.



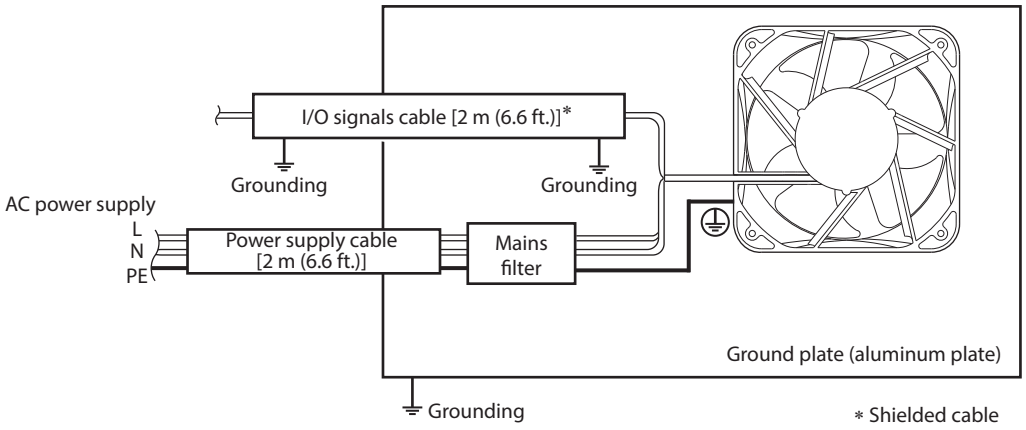
■ Wiring the I/O signal cable

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

■ Notes on installation and wiring

- Connect the fan directly to ground so that there is no potential difference between the ground of the fan and the ground of other peripheral control system equipment.
- When relays or electromagnetic switches are used with the product, use an AC line filter or CR circuit to suppress surges generated by them.
- Keep cables as short as possible without coiling and bundling extra lengths.
- Keep power lines, such as the power supply cable, separate from signal lines and at least 100 mm (3.94in.) apart. If a power cable and a signal cable must cross, cross them at right angles. Keep the AC input cable and output cable of the AC line filter separate from each other.

■ Example of installation and wiring

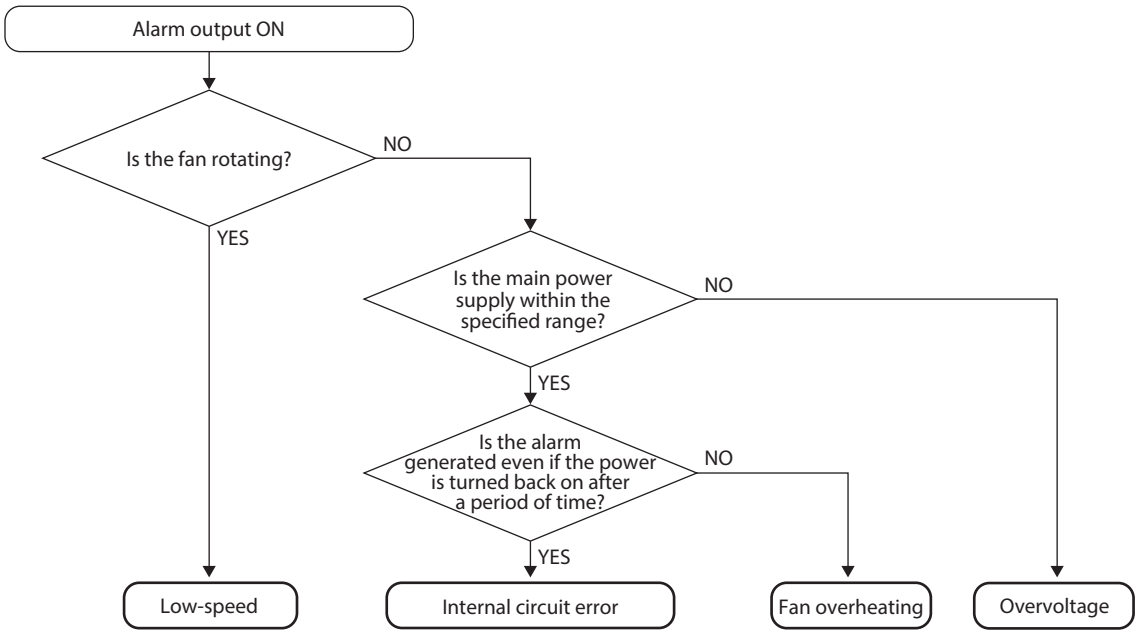


■ Precautions about static electricity

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

6 Alarms

Flow for identifying the cause when an alarm is generated



■ Alarm list

Name	Cause	Remedial action	Fan operation when an alarm is generated
Rotation deterioration	The fan speed was reduced by 40 % or more due to adhesion of foreign objects or a drop in the power supply voltage.	Check to see if there are any foreign objects that may be blocking the fan from rotating. Check the voltage of the main power supply.	Rotation continued
Overvoltage	The voltage of the main power supply has exceeded the specified value. (100-120 VAC input: Approximately 133 VAC)	Check the voltage of the main power supply.	Stop*
Fan overheating	The internal temperature of the fan has exceeded 90 °C (194 °F).	Check to see if the fan is being used within the ambient temperature range.	Stop
Internal circuit error	An abnormality such as overcurrent or circuit damage has been detected in the internal circuit of the fan.	Contact your nearest Oriental Motor sales office.	Stop

*When the cause of the alarm is removed to return the fan to the normal state, the fan will start rotating.

7 Inspection and maintenance

7-1 Inspection

It is recommended that periodic inspections for the items listed below are conducted after each operation.
If any abnormality occurs, stop using the product and contact your nearest Oriental Motor sales office.

■ Inspection items

- Check to see if any of the mounting screws of the fan are loose.
- Check to see if the fan is making unusual noises.
- Check to see if there is any unusual smell or appearance to the fan.

7-2 Warranty

Check on the Oriental Motor Website for the product warranty.

7-3 Disposal

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

8 Specifications

Check on the Oriental Motor Website for the product specifications.

■ General specifications

Operating environment	Ambient temperature	–20 to +60 °C (–4 to 140 °F) Standard speed type –20 to +55 °C (–4 to +131 °F) High speed type / variable speed type
	Ambient humidity	85 % or less (non-condensing)
	Altitude	Up to 1000 m (3 300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas or dust. Cannot be used in radioactive materials, magnetic field, vacuum or other special environments.
Storage environment Shipping environment	Ambient temperature	–20 to +70 °C (–4 to +158 °F) (non-freezing)
	Ambient humidity	85 % or less (non-condensing)
	Altitude	Up to 3000 m (10 000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas or dust. Cannot be used in radioactive materials, magnetic field, vacuum or other special environments.
Degree of protection		IP00

9 Regulations and standards

Check on the Oriental Motor Website for details about regulations and standards.

■ UL Standards, CSA Standards

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

■ CE Marking / UKCA Marking

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

- **EU Low Voltage Directive / UK Electrical Equipment (Safety) Regulations**

  Installation conditions (EN Standards)

  Overvoltage category: II
  Pollution degree: 2
  Class I equipment
  If the overvoltage category III is required according to the equipment, supply a rated voltage to the fan via the insulation transformer.
  Isolate the power (drive) cables from the signal cables by means of double insulation.

- **EU EMC Directive / UK EMC Regulations**

  For more information on compliance, refer to the "5-6 Compliance with EMC Directive/Regulations" on p.12.

- **EU RoHS Directive / UK RoHS Regulations**

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

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

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