

OPERATING MANUAL

Fan Speed Controller

FSC-24



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 "Safety precautions." In addition, be sure to observe the contents described in warning, caution, and note in this manual.

The product described in this document 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.

■ Applicable product

DC axial flow fans **MD Series V Type** (variable speed)

For information and precautions about handling the product, check the operating manual included with the applicable product.

Safety precautions

The precautions described below are intended to ensure the safe and correct 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

- Do not use the product in explosive or corrosive environments, in the presence of flammable gases or near combustibles. Doing so may result in fire or injury.
- 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 or injury.
- Always keep the power supply voltage within the specified range. Failure to do so may result in fire.
- Connect the product securely according to the connection diagram. Failure to do so may result in fire.
- Do not forcibly bend, pull or pinch the lead wire. Doing so may result in fire.
- 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.
- Do not disassemble or modify the product. Doing so may cause injury.

⚠ CAUTION

- Do not use the product beyond the specifications. Doing so may result in injury or damage to equipment.
- Keep the area around the product free of combustible materials. Failure to do so may result in fire or a skin burn(s).
- Do not touch the fan while operating. Doing so may cause injury. The use of an accessory finger guard is recommended to ensure protection.
- When an abnormality is noted, turn off the power immediately. Failure to do so may result in fire or injury.
- For the power supply, use a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock.

Thank you for purchasing an Oriental Motor product.

This Operating Manual describes product handling procedures and safety precautions.

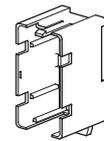
- Please read it thoroughly to ensure safe operation.
- Always keep the manual where it is readily available.

Preparation

■ Checking the product

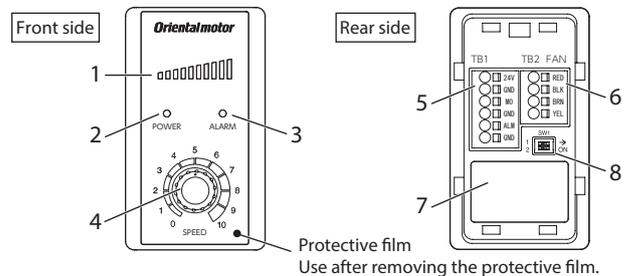
Verify that the items listed below are included. Report any missing or damaged items to the branch or sales office from which you purchased the product.

- Speed controller.....1 unit
- Wiring cover.....1 piece



- Operating manual (this document).....1 copy

■ Names and functions of parts



Number	Name	Indication	Function
1	Indicator (Green)	—	This indicator shows the fan speed (PWM output) in linking with the setting dial, as well as an alarm.
2	POWER LED (Green)	POWER	This LED is lit when the power is input.
3	ALARM LED (Red)	ALARM	This LED blinks when an alarm is generated.
4	Setting dial	SPEED	This setting dial is used to set the fan speed (PWM output).
5	I/O connection terminal	TB1	Connects the power supply, the speed switching input, and the alarm output.
6	Fan connection terminal	TB2 FAN	Connects a fan.
7	Nameplate	—	The model name, the serial number, and the year and month of manufacture are described.
8	Function select switches	SW1	Uses for switching the setting. Refer to p.3 for details.

Installation

■ Installation location

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

- Inside an enclosure installed indoors
 - Operating ambient temperature: -10 to +60 °C [+14 to +140 °F] (non-freezing)
 - Operating ambient humidity: 85% or less (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
 - Altitude: Up to 1000 m (3300 ft.) above sea level
 - 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.

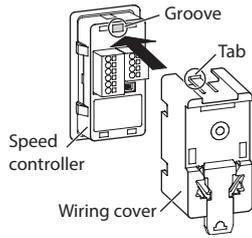
Installation method

Installation methods of the speed controller are shown below. After connecting a power supply and fan to the speed controller, attach the wiring cover before use.

Attaching the wiring cover

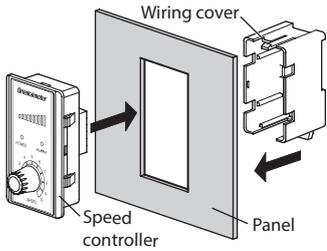
As shown in the figure, put the tab of the wiring cover into the groove of the speed controller until making a clicking sound. When removing the wiring cover from the speed controller, pull out while pressing the tab of the wiring cover.

The speed controller cannot be installed to a panel in a state where the wiring cover is attached.

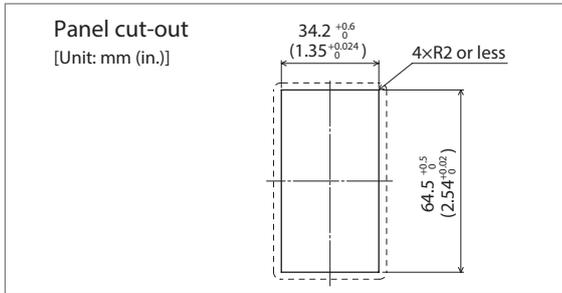


When installing to a panel

Install the speed controller to a flat panel offering excellent vibration resistance. Applicable thickness of panel: 2.0 to 3.0 mm (0.08 to 0.12 in.)

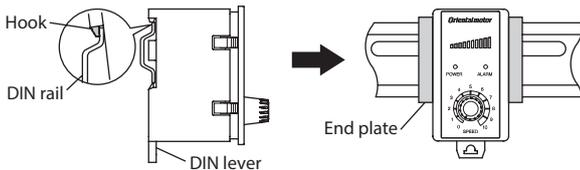


1. Assemble the speed controller to a panel.
2. Attach the wiring cover to the speed controller. Check if the speed controller is properly installed to the panel.



When installing to a DIN rail

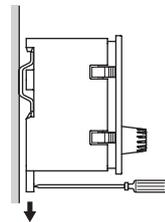
Use a DIN rail 35 mm (1.38 in.) wide to install the speed controller. Pull down the DIN lever of the speed controller, and push in the speed controller with hanging the hook at the rear to the DIN rail, and then lift the DIN lever. After installation, secure the both sides of the speed controller with the end plate that the customer provides.



Removing from DIN rail

Pull the DIN lever down using a screwdriver or the like, and lift the bottom of the speed controller to remove it from the rail.

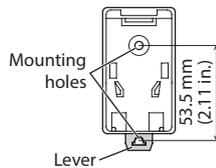
Use force of about 10 to 20 N (2.2 to 4.5 lb.) to pull the DIN lever down. Excessive force may damage the DIN lever.



When installing with screws

Secure the wiring cover using the mounting holes with two screws (M4: not included) in a state of removing the speed controller. Tightening torque: 0.7 N·m (6.1 lb-in) Install the speed controller after securing the wiring cover.

Use screws and washers, which sizes are \varnothing 10 mm (0.39 in.) or less, to secure the lever.

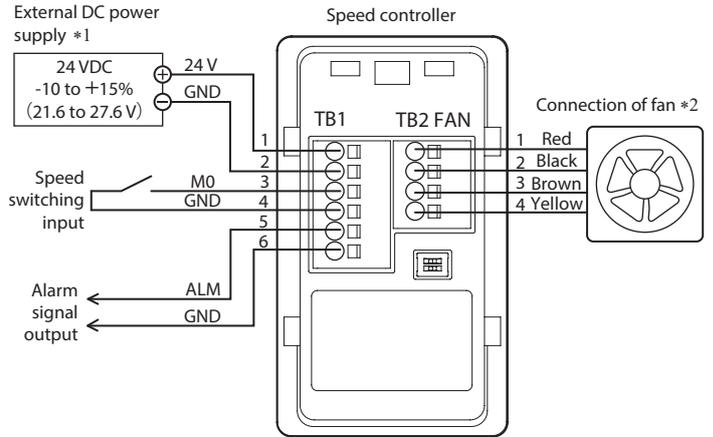


Note Check periodically if any of the tightened screws come loose. Re-tighten if the screw was loose.

Connection

Note Check the specification of the power supply voltage before applying the voltage. Applying a voltage exceeding the rated range may damage the product.

Connection method



*1 Check the specifications and number of fans connected, and use a power supply having a suitable capacity.

*2 Use crimp terminals to connect fans of MDV420, MDV515, MDV625, MDV825 and MDV925.

The maximum extension distance between the speed controller and fan is 2 m (6.6 ft.).

Connecting the TB1

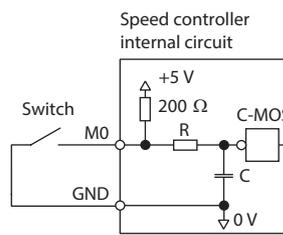
Pin assignment

Pin No.	Terminal name	Function	Description
1	24 V	Power supply input	Connects a 24 VDC power supply.
2	GND		
3	M0	Speed switching input	The fan speed can be switched between the rotation speed being set and the maximum speed. ON: Maximum speed OFF: Setting speed
4	GND		
5	ALM	Alarm signal output	This signal is output if an alarm is generated. (Normally closed)
6	GND		

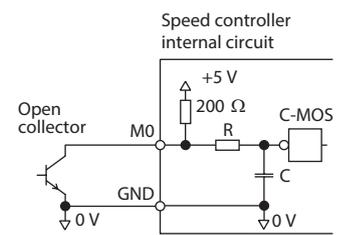
Internal configurations of circuit for speed switching input

The input signal circuit of the speed controller is C-MOS input.

In the case of connecting a switch



In the case of open-collector output

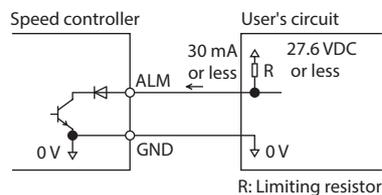


- Status of signal
ON: 0 to 1 V (L level) PWM output 100% fixed
OFF: 4 to 5 V (H level) PWM output variable
- Open circuit voltage 5 V_{typ}
- Outflow current: 20 to 30 mA

Internal configurations of circuit for alarm signal output

The output signal circuit of the speed controller is open-collector output.

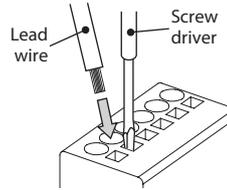
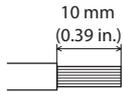
If a current significantly exceeding the specification is generated, the internal transistor is turned OFF.



- Status of signal
When a fan rotates: Internal transistor ON
When an alarm is generated (when a fan stops): Internal transistor OFF
- Maximum applied voltage: 27.6 VDC or less
- Maximum inflow current: 30 mA or less
- ON voltage: 1.5 VDC or less

● Wiring method (common to TB1 and TB2)

- Applicable lead wire
Lead wire size: Stranded wire AWG24 to AWG16
0.2 to 1.5 mm²
Conductive material: Use only copper wires.



- Applicable crimp terminal
Crimp terminals can also be used for connection. When crimp terminals are used, select the following products. If the lead wire diameter of a fan connected is AWG26, use the crimp terminal (AI 0,25-10).

Manufacturer: PHOENIX CONTACT GmbH & Co. KG
Model: AI 0,25-10 [AWG24 (0.25 mm²)]*
AI 0,34-10 [AWG22 (0.34 mm²)]*
AI 0,5-10 [AWG20 (0.5 mm²)]*
AI 0,75-10 [AWG18 (0.75 mm²)]*
* These are specifications of the manufacturer.

■ Connecting the TB2

Connect a fan used to the TB2.

Pin assignment

Pin No.	Terminal name	Function	Color of fan lead wire
1	RED	Fan power supply terminal (+)	Red
2	BLK	Fan power supply terminal (GND)	Black
3	BRN	PWM signal output	Brown
4	YEL	Pulse sensor input	Yellow

Operation

Do not turn on the power supply until the wiring is completed.

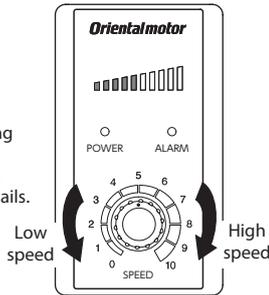
■ Operating method

① Operation

The fan starts rotating when the power supply is turned on.

② Variable speed

The fan speed can be adjusted using the setting dial. It is set to "5" at the time of shipment. The variable speed range varies depending on the fan model. Refer to the table below for details.



③ Stop

The fan stops if the power supply is turned off.

Setting dial	0	1	2	3	4	5	6	7	8	9	10
PWM duty [%]	0	10	20	30	40	50	60	70	80	90	100
Fan rotation speed	LOW HIGH										
Indication level on indicator											
	When dial is set to 0					When dial is set to 10					

• Variable speed range

Model	MDV420, MDV515, MDV1238	MDV625, MDV825, MDV925, MDV1225
PWM duty [%]	20 to 100 *1	0 to 100
Operation when the setting dial is "0"	Stop The stall alarm is generated.	Rotating *2 It can be changed with the function select switches.

*1 If the PWM duty cycle falls below 20%, the fan may not rotate.

*2 The fan speed when the setting dial is set to "0" is as shown in the table below. The fan speed varies depending on the fan model.

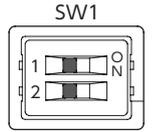
MDV625	MDV825	MDV925	MDV1225
2850 r/min	1400 r/min	1500 r/min	1650 r/min

● Function select switches

The new settings to the function select switches will be updated after the power is turned on again.

Factory setting: OFF

No.	Description
SW1-1	Selection of stall alarm OFF: Enabled ON: Disabled Set this switch to ON when connecting two or more fans.
SW1-2	Selection of operation when the setting dial is "0" OFF: Fan rotates. The PWM duty is 0%. *1 ON: Fan stops. The power supply for fan is turned off. *2



*1 The MDV420, MDV515 and MDV1238 fans stop when the PWM duty is 0%.

*2 The stall alarm is not output.

■ Multi-fan control

Speeds of two or more fans can be adjusted using a single speed controller.

When the multi-fan control is performed, set the function select switch (SW1-1) to ON to disable the stall alarm. Also, use fans with the same frame size for the multi-fan control. Do not combine fans with different frame sizes.



Do not connect multiple fans to the pulse sensor input.

The speed controller can capture the pulse sensor output for only one fan.

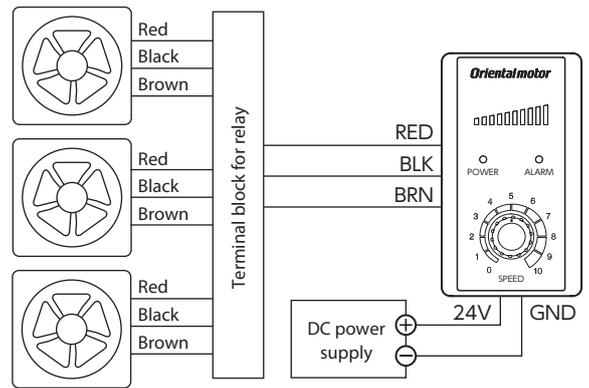
When capturing it for only one fan, turn the function select switch (SW1-1)

OFF to enable the stall alarm.

When the multi-fan control is performed with connecting the power supply and PWM signal output

- Number of fans possible to perform the multi-fan control

MDV420, MDV515, MDV625, MDV825, MDV925: 4 units
MDV1225, MDV1238: 2 units

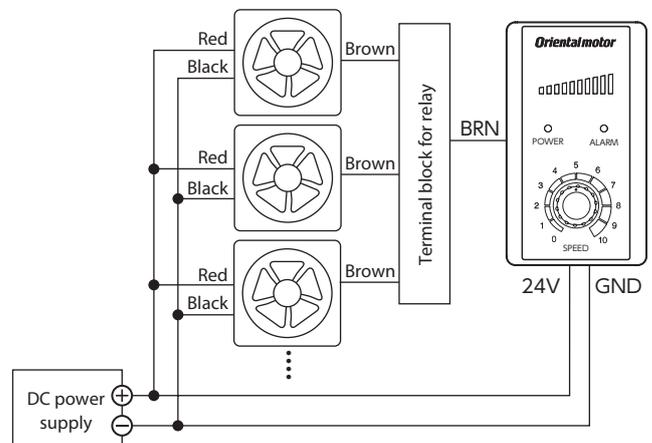


When the multi-fan control is performed with connecting the PWM signal output

Up to eight fans can be connected.

However, supplying the power to fans are required separately.

When power supplies are used for the fans and the speed controller respectively, be sure to connect to a common ground.



Alarm

If an abnormality occurred in the speed controller or fan, the ALARM LED on the speed controller blinks in red. Also, the alarm message can be checked by the indication level of the indicator. If the fan was stopped, ensure safety before removing the cause of the alarm.

Alarm lists

Indicator status	Item	Cause	Remedial action	Status of fan
	Stall	The fan was stopped.	Check the lifetime of the fan or adherence of a foreign particle.	Stop *1
		There is no pulse sensor output from the fan.	Check if there is a disconnection in the lead wires of the fan.	Rotating
	Overvoltage	The power supply voltage exceeded approximately 30 VDC.	Check the power supply voltage.	Stop *2
	Undervoltage	The power supply voltage fell below approximately 18 VDC.		
	Overheat	The internal temperature of the speed controller exceeded the specified value.	Check the number of units connected and the operating ambient temperature.	

*1 The fan starts rotating when the cause that the fan has stopped is removed.

*2 The fan automatically starts rotating when the cause of the alarm is removed and the power supply is turned on again.

"Stall" alarm

The MD Series V type fans have a function of the pulse sensor output. The speed controller can capture the pulse sensor output of the fan and output as the stall alarm if the fan stops.

Inspection and maintenance

Inspection

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

Inspection item

- Check if any of mounting screws of the speed controller or fan come loose.
- Check if the speed controller or fan generates unusual noises.
- Check if the speed controller has unusual smells or appearance defects.

Warranty

Check on the Oriental Motor Website for the product warranty.

Disposal

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

General specifications

Operating environment	Ambient temperature	-10 to +60 °C [+14 to +140°F] (non-freezing)
	Ambient humidity	85% or less (non-condensing)
	Altitude	Up to 1000 m (3300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water, or oil Cannot be used in radioactive materials, magnetic field, vacuum or other special environment
Storage 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 (10000 ft.) above sea level
Shipping environment	Surrounding atmosphere	No corrosive gas, dust, water, or oil Cannot be used in radioactive materials, magnetic field, vacuum or other special environment

Regulations and standards

CE Marking

This product is affixed the CE Marking under the EMC Directive.

EMC Directive

This product has received EMC compliance under the conditions specified in "Example of installation and wiring."

Applicable Standards

EMI: EN 55011 group1 class A, EN 61000-6-4 EMS: EN 61000-6-2

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.

RoHS Directive

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

Installing and wiring in compliance with EMC Directive

FSC-24 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. Installation and wiring methods of FSC-24 explained here represent the basic methods that are effective in helping your mechanical equipment conform to the EMC Directive. The final level of conformance of your mechanical equipment to the EMC Directive will vary depending on control system equipment including FSC-24 and fans, configuration of electrical parts, wiring, layout, and the like. It therefore must be verified through conducting EMC measures on your mechanical equipment.

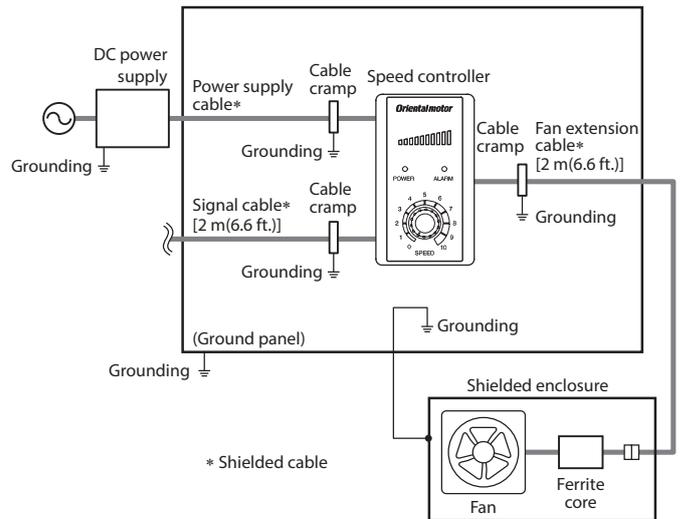
Without effective measures to suppress the electromagnetic interference (EMI) caused by FSC-24 in the surrounding control system equipment and the electromagnetic spectrum (EMS) generated by FSC-24, the function of your mechanical equipment may be seriously affected. Implementing the following installation and wiring methods allows FSC-24 to conform to the EMC Directive.

Ferrite core

When extending the cable, wind the cable around a ferrite core twice before use. The ferrite core reduces the negative effects of external noise.

Use a ferrite core of the model ZCAT3035-1330 (TDK Corporation) or its equivalent. Install the ferrite core as close as possible to the fan.

Example of installation and wiring



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Published in January 2022

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