Cooling Fans
This catalog contains information necessary for informed product selection. Additional product details and information not outlined in this catalog can be found in each product’s individual operating manual. Operating manuals can be downloaded from our website or obtained by contacting technical support or your nearest Oriental Motor sales office.
Overview of Cooling Fans

Today’s comfortable life and society is supported by advanced control systems, which may present many heat sources. To operate these devices 24 hours a day, 365 days a year, the devices require appropriate heat designs and heat measures. Oriental Motor offers a wide range of heat measure products centered on cooling fans to meet these requirements.

About a Cooling Fan

One method of cooling heat sources and enclosures is air cooling, which utilizes the air around us. One device that can use this air is a cooling fan, which uses the power of a motor to spin a propeller or impeller to blow air. Oriental Motor provides three types of fans: axial flow fans, centrifugal blowers and cross flow fans, using different air-blowing systems.

Highly Reliable Equipment Design Using Cooling Fans

Even if the temperature of a heat source rises, cooling is not required if the temperature will not affect the heat source itself or peripheral equipment. However, if there is a danger that the heat will cause damage, some kind of cooling is required. There are two methods of cooling heat sources; natural air cooling and forced cooling. When forced cooling is required, cooling fans perform the appropriate ventilation and air-blowing. By using a cooling fan, the temperature of a heat source and its surroundings can be decreased, which enables extended equipment life, and more reliable equipment design.

Thermal Management System

We can enjoy a comfortable life at home and work today thanks to advanced control systems. However, the devices that function as the core of such systems present many heat sources.

To operate these devices 24 hours a day, 365 days a year, the devices require appropriate heat designs and heat measures.

Oriental Motor can recommend the ideal products for you by examining your specific needs from the viewpoint of the Thermal Management System.
### Product Line

#### Cooling Fans

**Axial Flow Fans**
A large air flow is feature of axial flow fans. Various types are available, including large size and small size.

**Centrifugal Blowers**
A large static pressure and concentrated air flow are features of centrifugal blowers.

**Cross Flow Fans**
A wide, uniform air flow is a feature of cross flow fans.

**Cooling Module**
Both IP55 and IP43 models are available. Various types are available, including a suction type and exhaust type.

#### Thermostats
Thermostat automatically performs ON/OFF fan control in accordance with temperature fluctuation inside equipment.

#### Equipment that is used in combination with a cooling fan, etc.
## Applications and Classifications

The features of cooling fans differ according to their air-blowing system. In this selection guide, we explain each selection according to the type of air-blowing system and demonstrate with example applications. Refer to “Cooling Fans Selection Guide (Selection Based on Characteristics)” for selection according to maximum air flow and maximum static pressure, and “Cooling Fans Selection Guide (Selection Based on Purpose and Functions)” for selection according to additional functions.

<table>
<thead>
<tr>
<th>Ventilation, Cooling, Drying, and Suction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Device Ventilation and Cooling</strong></td>
</tr>
<tr>
<td>The large air flow of axial flow fans is suitable for ventilation and cooling inside electronic device.</td>
</tr>
<tr>
<td>![Axial Flow Fans](Page F-25)</td>
</tr>
<tr>
<td><strong>Cooling Densely Mounted Devices</strong></td>
</tr>
<tr>
<td>Enables energy-saving and less wiring compared to using multiple small fans.</td>
</tr>
<tr>
<td>![Axial Flow Fans](Page F-25)</td>
</tr>
<tr>
<td><strong>Air-Blow Cooling or Drying</strong></td>
</tr>
<tr>
<td>Centrifugal blowers offering high static pressures are suitable for the air-blow cooling of work pieces following heat treatment.</td>
</tr>
<tr>
<td>![Centrifugal Blowers](Page F-79)</td>
</tr>
<tr>
<td><strong>Cooling with High Static Pressure</strong></td>
</tr>
<tr>
<td>The high static pressure of centrifugal blowers makes them suitable for cooling used together with thick filters that are subject to significant pressure losses.</td>
</tr>
<tr>
<td>![Centrifugal Blowers](Page F-79)</td>
</tr>
<tr>
<td><strong>Uniform Cooling or Drying</strong></td>
</tr>
<tr>
<td>Cross flow fans are suitable for the air-blow cooling of wide areas.</td>
</tr>
<tr>
<td>![Cross Flow Fans](Page F-101)</td>
</tr>
<tr>
<td><strong>Cooling of Long and Thin Space</strong></td>
</tr>
<tr>
<td>Suitable for air-blow cooling of long and thin spaces, such as where electronic devices are installed.</td>
</tr>
<tr>
<td>![Cross Flow Fans](Page F-101)</td>
</tr>
</tbody>
</table>
Easy Installation and Measures for Preventing Water Droplets and Dust from Entering

- **Easy Installation and Easy Maintenance**
  The module can be easily installed from the outside. The filter can be replaced from outside the equipment, and maintenance is also easy.

- **Ventilation and Cooling Inside Control Box**
  Suitable for ventilation and cooling inside a control box installed in an environment where powdery dust is mixed in with the air. Improves the reliability of the entire control box.

Automatically Turning the Cooling Fan ON/OFF

- **Automatically Turning it ON/OFF with a Set Temperature**
  The cooling fan is automatically turned ON or OFF when the temperature inside the equipment reaches the temperature switch setting.

Thermostats

- **Page F-113**

Example of combination with cooling fans
Product Line-up of Cooling Fans

Product Line-up

We offer a wide range of fans in varying frame sizes and voltage specifications. Products with additional functions, such as alarm types and speed control types, are available.
### Product Line

**Cooling Fans**

#### Axial Flow Fans (AC Input)

<table>
<thead>
<tr>
<th>MRS Series</th>
<th>Frame Size [mm (in.)]</th>
<th>250 (9.84)</th>
<th>200 (7.87)</th>
<th>180 (7.09)</th>
<th>160 (6.30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large AC axial flow fans.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large air flow and high static pressure. Full lineup.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MU Series</th>
<th>Frame Size [mm (in.)]</th>
<th>119 (4.69)</th>
<th>92 (3.62)</th>
<th>80 (3.15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small AC axial flow fans.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full lineup.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### MRE Series

<table>
<thead>
<tr>
<th>Frame Size [mm (in.)]</th>
<th>180 (7.09)</th>
<th>160 (6.30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-Life fans have an expected life of 100000 hours.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Axial Flow Fans (DC Input)**

#### MDS Series/MD Series

<table>
<thead>
<tr>
<th>Frame Size [mm (in.)]</th>
<th>172 (6.77)</th>
<th>140 (5.51)</th>
<th>119 (4.69)</th>
<th>92 (3.62)</th>
<th>80 (3.15)</th>
<th>62 (2.44)</th>
</tr>
</thead>
<tbody>
<tr>
<td>These are axial flow fans that employ a brushless DC motor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### MDA Series

<table>
<thead>
<tr>
<th>Frame Size [mm (in.)]</th>
<th>140 (5.51)</th>
<th>119 (4.69)</th>
<th>92 (3.62)</th>
<th>80 (3.15)</th>
<th>62 (2.44)</th>
</tr>
</thead>
<tbody>
<tr>
<td>These are axial flow fans that employ a brushless DC motor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>These fans are equipped with a circuit that outputs an alarm when the fan speed drops due to the life of the fan, an external factor, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### MDE Series

<table>
<thead>
<tr>
<th>Frame Size [mm (in.)]</th>
<th>140 (5.51)</th>
<th>119 (4.69)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-life DC axial flow fans adopting brushless DC motors, with an expected life of 100000 hours. Stall alarm comes standard.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

→ Page F-32
→ Page F-48
→ Page F-56
→ See website
→ See website
→ Page F-74
**Cooling Fans**

### Centrifugal Blowers (AC Input)

**MB Series**

Impeller Diameter [mm (in.)]  160 (6.30)  120 (4.72)  100 (3.94)  80 (3.15)  60 (2.36)  50 (1.97)

AC centrifugal blowers that have a large static pressure and can produce directional air flow. Full lineup.

→ Page F-82

### Centrifugal Blowers (DC Input)

**MBD Series**

Impeller Diameter [mm (in.)]  120 (4.72)  100 (3.94)  80 (3.15)

DC centrifugal blowers. Low-speed alarm type and pulse sensor type.

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### Cross Flow Fans (AC Input)

**MF Series**

Impeller Length [mm (in.)]  300 (11.81)  150 (5.91)

AC cross flow fans with wide, uniform air flow.

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### Cross Flow Fans (DC Input)

**MFD Series**

Impeller Length [mm (in.)]  300 (11.81)  150 (5.91)

DC cross flow fans with wide, uniform air flow.

→ Page F-104

### Cooling Module

**FM Series**

Degree of Protection  IP43  IP55

Modular products that include guards and filters to prevent foreign objects, dust, and water droplets from reaching the cooling fan.

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### Thermostats

**AM1-WA1/AM1-XA1**

Switches that detect the ambient temperature and automatically turn the AC cooling fan ON/OFF. The fans can be operated only when necessary for energy-saving control.

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### Accessories

The following accessories that can be used with each cooling fan are available.

- Finger Guards
- Filters
- Screens
- Plug Cords
- Mounting Brackets
- Duct Joints

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To achieve objective work, the cooling fan needs to be selected in consideration of required performance as well as features of air flow. The maximum air flow and maximum static pressure vary depending on the series and size of cooling fans. Select the cooling fan offering the characteristics that best suit the specifications of your equipment.

### Maximum Air Flow

The following tables indicate the maximum air flow for each type and series.

#### AC Axial Flow Fans

<table>
<thead>
<tr>
<th>Max. Air Flow [m³/min (CFM)]</th>
<th>Frame Size [mm (in.)]</th>
<th>Thickness [mm (in.)]</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>21/24 (742/848)</td>
<td>□ 250 ≤9.84</td>
<td>120 (4.72)</td>
<td>MRS25</td>
<td>F-32</td>
</tr>
<tr>
<td>13.2/15.5 (466/547)</td>
<td>□ 200 ≤7.87</td>
<td>90 (3.54)</td>
<td>MRE20</td>
<td>F-34</td>
</tr>
<tr>
<td>11/12.8 (388/452)</td>
<td>□ 180 ≤7.09</td>
<td>90 (3.54)</td>
<td>MRS18</td>
<td>F-36</td>
</tr>
<tr>
<td>6.2/7.3 (219/258)</td>
<td>□ 160 ≤6.30</td>
<td>62 (2.44)</td>
<td>MRS16</td>
<td>F-40</td>
</tr>
<tr>
<td>4.5/4.6 (159/162)</td>
<td>□ 140 ≤5.51</td>
<td>47 (1.85)</td>
<td>MRS14</td>
<td>F-44</td>
</tr>
<tr>
<td>2.7/3.0 (95.3/106)</td>
<td>□ 119 ≤4.69</td>
<td>38 (1.50)</td>
<td>MU1238</td>
<td>F-48</td>
</tr>
<tr>
<td>1.6/1.9 (56.5/61.1)</td>
<td>□ 119 ≤4.69</td>
<td>25 (0.98)</td>
<td>MU1225</td>
<td>F-50</td>
</tr>
<tr>
<td>0.95/1.10 (33.5/38.8)</td>
<td>□ 90 ≤3.62</td>
<td>25 (0.98)</td>
<td>MU925</td>
<td>F-52</td>
</tr>
<tr>
<td>0.45/0.55 (15.9/19.4)</td>
<td>□ 80 ≤3.15</td>
<td>25 (0.98)</td>
<td>MU825</td>
<td>F-54</td>
</tr>
</tbody>
</table>

#### DC Axial Flow Fans

<table>
<thead>
<tr>
<th>Max. Air Flow [m³/min (CFM)]</th>
<th>Frame Size [mm (in.)]</th>
<th>Thickness [mm (in.)]</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 (212)</td>
<td>□ 172 (6.77)</td>
<td>51 (2.01)</td>
<td>MDS1751</td>
<td>F-56</td>
</tr>
<tr>
<td>5.8 (205)</td>
<td>□ 140 (5.51)</td>
<td>51 (2.01)</td>
<td>MDA1451</td>
<td>F-58</td>
</tr>
<tr>
<td>2.7 (95.3)</td>
<td>□ 119 (4.69)</td>
<td>25.4 (1.00)</td>
<td>MDE1451</td>
<td>F-74</td>
</tr>
<tr>
<td>2.5 (88.3)</td>
<td>□ 92 (3.62)</td>
<td>25.4 (1.00)</td>
<td>MDS1225</td>
<td>F-60</td>
</tr>
<tr>
<td>1.3 (45.9)</td>
<td>□ 80 (3.15)</td>
<td>25.4 (1.00)</td>
<td>MDA1225</td>
<td>F-64</td>
</tr>
<tr>
<td>1 (35.3)</td>
<td>□ 60 (2.36)</td>
<td>25.4 (1.00)</td>
<td>MDS825</td>
<td>F-66</td>
</tr>
<tr>
<td>0.5 (177)</td>
<td>□ 50 (2.00)</td>
<td>25.4 (1.00)</td>
<td>MDA825</td>
<td>F-68</td>
</tr>
<tr>
<td>0.27 (9.53)</td>
<td>□ 40 (1.65)</td>
<td>10 (0.39)</td>
<td>MD5510</td>
<td>F-70</td>
</tr>
<tr>
<td>0.18 (6.35)</td>
<td>□ 32 (1.26)</td>
<td>10 (0.39)</td>
<td>MD5410</td>
<td>F-72</td>
</tr>
</tbody>
</table>

#### Centrifugal Blowers

<table>
<thead>
<tr>
<th>Max. Air Flow [m³/min (CFM)]</th>
<th>Impeller Diameter [mm (in.)]</th>
<th>Power Supply</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.0/9.0 (282/318)</td>
<td>□ 160 (6.30)</td>
<td>AC Input</td>
<td>MB1665</td>
<td>F-82</td>
</tr>
<tr>
<td>4.4/5.1 (155/180)</td>
<td>□ 120 (4.72)</td>
<td>AC Input</td>
<td>MB1255</td>
<td>F-84</td>
</tr>
<tr>
<td>2.3/2.6 (81.2/91.8)</td>
<td>□ 100 (4.34)</td>
<td>AC Input</td>
<td>MB1040</td>
<td>F-86</td>
</tr>
<tr>
<td>1.6/1.8 (56.5/63.5)</td>
<td>□ 80 (3.15)</td>
<td>AC Input</td>
<td>MB840</td>
<td>F-88</td>
</tr>
<tr>
<td>0.44/0.36 (15.5/12.7)</td>
<td>□ 60 (2.36)</td>
<td>AC Input</td>
<td>MB630</td>
<td>F-90</td>
</tr>
<tr>
<td>0.21/0.24 (74/8.47)</td>
<td>□ 50 (1.97)</td>
<td>DC Input</td>
<td>MB520</td>
<td>F-92</td>
</tr>
<tr>
<td>3 (106)</td>
<td>□ 120 (4.72)</td>
<td>DC Input</td>
<td>MBD12</td>
<td>F-94</td>
</tr>
<tr>
<td>1.95 (68.8)</td>
<td>□ 100 (4.34)</td>
<td>DC Input</td>
<td>MBD10</td>
<td>F-96</td>
</tr>
<tr>
<td>1.45 (51.2)</td>
<td>□ 80 (3.15)</td>
<td>DC Input</td>
<td>MBD8</td>
<td>F-98</td>
</tr>
</tbody>
</table>

#### Cross Flow Fans

<table>
<thead>
<tr>
<th>Max. Air Flow [m³/min (CFM)]</th>
<th>Impeller Length [mm (in.)]</th>
<th>Power Supply</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0/6.2 (212/219)</td>
<td>300 (11.81)</td>
<td>AC Input</td>
<td>MF930</td>
<td>F-104</td>
</tr>
<tr>
<td>3.4/3.7 (120/131)</td>
<td>150 (5.91)</td>
<td>DC Input</td>
<td>MFD90</td>
<td>F-108</td>
</tr>
<tr>
<td>5.2 (184)</td>
<td>300 (11.81)</td>
<td>DC Input</td>
<td>MFD915</td>
<td>F-108</td>
</tr>
</tbody>
</table>
## Maximum Static Pressure

The following tables indicate the maximum static pressure for each series.

### AC Axial Flow Fans

<table>
<thead>
<tr>
<th>Max. Static Pressure [Pa (inH2O)] For 50/60 Hz</th>
<th>Frame Size [mm (in.)]</th>
<th>Thickness [mm (in.)]</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>290/320 (1.16/1.28)</td>
<td>250 (9.84)</td>
<td>120 (4.72)</td>
<td>MRS25</td>
<td>F-32</td>
</tr>
<tr>
<td>221/186 (0.886/0.746)</td>
<td>200 (7.87)</td>
<td>90 (3.54)</td>
<td>MRS20</td>
<td>F-34</td>
</tr>
<tr>
<td>196/245 (0.786/0.982)</td>
<td>180 (7.09)</td>
<td>90 (3.54)</td>
<td>MRS18, MRE18</td>
<td>F-36</td>
</tr>
<tr>
<td>127/157 (0.509/0.63)</td>
<td>160 (6.30)</td>
<td>62 (2.44)</td>
<td>MRS16, MRE16</td>
<td>F-40</td>
</tr>
<tr>
<td>92/181 (0.369/0.325)</td>
<td>119 (4.69)</td>
<td>38 (1.50)</td>
<td>MRS14</td>
<td>F-44</td>
</tr>
<tr>
<td>81/181 (0.325/0.325)</td>
<td>119 (4.69)</td>
<td>25 (0.98)</td>
<td>MU1225</td>
<td>F-50</td>
</tr>
<tr>
<td>49/44 (0.196/0.176)</td>
<td>92 (3.62)</td>
<td>25 (0.98)</td>
<td>MU925</td>
<td>F-52</td>
</tr>
<tr>
<td>34/49 (0.137/0.196)</td>
<td>80 (3.15)</td>
<td>25 (0.98)</td>
<td>MU825</td>
<td>F-54</td>
</tr>
</tbody>
</table>

### DC Axial Flow Fans

<table>
<thead>
<tr>
<th>Max. Static Pressure [Pa (inH2O)]</th>
<th>Frame Size [mm (in.)]</th>
<th>Thickness [mm (in.)]</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>137 (0.549)</td>
<td>ø172 (6.77)</td>
<td>51 (2.01)</td>
<td>MDS1751</td>
<td>F-56</td>
</tr>
<tr>
<td>130 (0.521)</td>
<td>ø140 (5.51)</td>
<td>51 (2.01)</td>
<td>MDS1451, MDA1451</td>
<td>F-58</td>
</tr>
<tr>
<td>86 (0.345)</td>
<td>ø119 (4.69)</td>
<td>10 (0.39)</td>
<td>MDS410</td>
<td>F-72</td>
</tr>
<tr>
<td>70 (0.281)</td>
<td>ø119 (4.69)</td>
<td>25.4 (1.00)</td>
<td>MDS1225, MDA1225</td>
<td>F-60</td>
</tr>
<tr>
<td>54 (0.217)</td>
<td>ø52 (2.05)</td>
<td>10 (0.39)</td>
<td>MDS510</td>
<td>F-70</td>
</tr>
<tr>
<td>49 (0.196)</td>
<td>ø92 (3.62)</td>
<td>25.4 (1.00)</td>
<td>MDS925, MDA925</td>
<td>F-64</td>
</tr>
<tr>
<td>43 (0.172)</td>
<td>ø119 (4.69)</td>
<td>25.4 (1.00)</td>
<td>MDSB25, MDA825</td>
<td>F-66</td>
</tr>
</tbody>
</table>

### Centrifugal Blowers

<table>
<thead>
<tr>
<th>Max. Static Pressure [Pa (inH2O)] For 50/60 Hz</th>
<th>Impeller Diameter [mm (in.)]</th>
<th>Power Supply</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>490/686 (1.96/2.75)</td>
<td>ø160 (6.30)</td>
<td>AC Input</td>
<td>MB1665</td>
<td>F-82</td>
</tr>
<tr>
<td>309/441 (1.24/1.77)</td>
<td>ø120 (4.72)</td>
<td>AC Input</td>
<td>MB1255</td>
<td>F-84</td>
</tr>
<tr>
<td>206/284 (0.826/1.14)</td>
<td>ø100 (4.34)</td>
<td>AC Input</td>
<td>MB1040</td>
<td>F-86</td>
</tr>
<tr>
<td>152/221 (0.610/0.886)</td>
<td>ø80 (3.15)</td>
<td>AC Input</td>
<td>MB840</td>
<td>F-88</td>
</tr>
<tr>
<td>53/76 (0.213/0.305)</td>
<td>ø60 (2.36)</td>
<td>AC Input</td>
<td>MB630</td>
<td>F-90</td>
</tr>
<tr>
<td>37/53 (0.149/0.213)</td>
<td>ø50 (2.00)</td>
<td>DC Input</td>
<td>MB520</td>
<td>F-92</td>
</tr>
<tr>
<td>294 (1.18)</td>
<td>ø120 (4.72)</td>
<td>DC Input</td>
<td>MBD12</td>
<td>F-94</td>
</tr>
<tr>
<td>196 (0.786)</td>
<td>ø80 (3.15)</td>
<td>DC Input</td>
<td>MBD8</td>
<td>F-98</td>
</tr>
</tbody>
</table>

### Cross Flow Fans

<table>
<thead>
<tr>
<th>Max. Static Pressure [Pa (inH2O)] For 50/60 Hz</th>
<th>Impeller Length [mm (in.)]</th>
<th>Power Supply</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>74/103 (0.297/0.414)</td>
<td>300 (11.81)</td>
<td>AC Input</td>
<td>MF930</td>
<td>F-104</td>
</tr>
<tr>
<td>88/127 (0.353/0.509)</td>
<td>155 (6.11)</td>
<td>DC Input</td>
<td>MF915</td>
<td>F-104</td>
</tr>
<tr>
<td>83 (0.333)</td>
<td>300 (11.81)</td>
<td>DC Input</td>
<td>MF930</td>
<td>F-104</td>
</tr>
<tr>
<td>98 (0.393)</td>
<td>155 (6.11)</td>
<td>DC Input</td>
<td>MF915</td>
<td>F-104</td>
</tr>
</tbody>
</table>
## Cooling Fans Selection Guide (Selection Based on Purpose and Functions)

You can improve the reliability of your equipment and reduce its overall cost by combining fans and peripheral products. Oriental Motor recommends optimal product combinations and their effective use in order to meet specific requests. We would be happy to assist you in the design of your equipment.

<table>
<thead>
<tr>
<th>Customer Needs/Task</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detect service life or trouble-related abnormality</td>
<td></td>
</tr>
<tr>
<td>Reduce time and costs with replacement</td>
<td></td>
</tr>
<tr>
<td>Install in hard-to-service location</td>
<td></td>
</tr>
<tr>
<td>Improve cooling efficiency</td>
<td></td>
</tr>
<tr>
<td>High installation density inside the equipment, air cannot flow easily</td>
<td></td>
</tr>
<tr>
<td>Protect against foreign objects, dust, and water droplets</td>
<td></td>
</tr>
<tr>
<td>Easy installation and maintenance</td>
<td></td>
</tr>
<tr>
<td>Regulate air flow and static pressure</td>
<td></td>
</tr>
<tr>
<td>Keep temperature in equipment constant</td>
<td></td>
</tr>
<tr>
<td>Eliminate unnecessary operation to reduce power consumption and noise</td>
<td></td>
</tr>
<tr>
<td>Simplify the ordering process</td>
<td></td>
</tr>
<tr>
<td>Use the fan right away</td>
<td></td>
</tr>
</tbody>
</table>

- Low-speed Alarm Type Cooling Fans, Stall Alarm Type Cooling Fans and Pulse Sensor Type Cooling Fans: Page F-13
- Long Life Axial Flow Fans: Page F-14
- Selecting for Efficient Cooling: Page F-15
- Cooling Module: Page F-16
- Variable Flow Type: Page F-46
- Thermostats: Page F-17
- Fan Kit: Page F-18
Low-speed Alarm Type Cooling Fans, Stall Alarm Type Cooling Fans, and Pulse Sensor Type Cooling Fans

Fans with a low-speed alarm or, stall alarms or pulse sensors enable detection of cooling problems in devices on which fans are installed. This alerts for prompt maintenance and keeps the equipment in a highly reliable condition.

The Advantages of Using Alarm Type and Sensor Type Products

If a cooling fan is left stopped or at low speed, the internal temperature increases which has an effect on the equipment. By using a low-speed alarm type cooling fan or stall alarm type cooling fan, cooling problems are detected early to allow for maintenance.

Lineup

- **Fans with Low-Speed Alarms**
  
  An alarm is output when the fan speed drops due to the service life of the fan or the ingress of foreign objects. This makes it possible to order and replace the fan with a new one before it stops.
  
  If multiple cooling fans are being used, it is possible to only replace the cooling fan with decreased cooling capacity. Even if the cooling capacity of the fan decreases, the effect of that on the equipment can be minimized.

- **Fans with Stall Alarm**
  
  Outputs an alarm when the cooling fan stops. Quickly detects defective stops to allow the cooling fan to be replaced.

- **Fans with Pulse Sensor**
  
  Outputs a pulse signal while the cooling fan is rotating.

**Lineup**

- AC Axial Flow Fans
  - MRS Series ➜ Page F-32
  - MRE Series ➜ See website
- DC Axial Flow Fans
  - MDS Series ➜ Page F-56
  - MDA Series ➜ See website
- DC Centrifugal Blowers
  - MBD Series ➜ Page F-94
- DC Cross Flow Fans
  - MFD Series ➜ Page F-104

- DC Axial Flow Fans
  - MDS Series ➜ Page F-56
  - MD Series ➜ Page F-62
  - MDE Series ➜ Page F-74
## Long Life Axial Flow Fans

You can decrease the number of fans that need replacement by using long-life axial flow fans with an expected life of 100000 hours.

### About Long-life Axial Flow Fans

These axial flow fans have an expected life of 100000 hours (about 11 years). They reduce the increase in bearing temperature, inhibit grease deterioration and improve vibration resistance and shock resistance through bearing enlargement. They also increase the life of circuits and couplers and reduce failure rate. They are designed based on the concept of initial failure so that random failure and wear-out failure will not occur, allowing for 100000 hours of continuous operation or more (survival rate of 90% or higher).

### About Expected Life

The 100000 hours of expected life indicates that more than 90% of fans will satisfy the following criteria when used at an ambient temperature of 60°C (140°F).

Criteria: Speed (at rated voltage): Greater than 70% of rated speed
Input Current (at rated voltage): Less than 130% of rated current

### Lineup

**AC Axial Flow Fans**
- **MRE Series**
  - □180 mm – 90 mm Thick (□6.30 in. – 2.44 in. Thick) With/Without Low-Speed Alarm
  - □160 mm – 62 mm Thick (□7.09 in. – 3.54 in. Thick) With/Without Low-Speed Alarm

**DC Axial Flow Fans**
- **MDE Series**
  - □140 mm – 51 mm Thick (□5.51 in. – 2.01 in. Thick) With Stall Alarm
  - □119 mm – 25.4 mm Thick (□4.69 in. – 1.00 in. Thick) With Stall Alarm

### The Advantages of Using Long-life Axial Flow Fans

#### Reduction of Equipment Maintenance
Long-life axial flow fans have an expected life of 100000 hours, so the number of cooling fans that need replacing is decreased compared to conventional models.

#### Equipment That Requires High Reliability
Expected life of 100000 hours or more (continuous operation). Suitable for applications where continuous operation is required when a failure has had a large effect on systems and equipment.

**Applications**
- Back-up equipment for power failures
- Equipment installed in data centers, etc.
- Plant equipment that is continuously operational

#### Early Detection of Reduced Air Flow Capacity and Other Abnormalities (Low-Speed Alarm, Stall Alarm)
If the cooling fan is a low-speed alarm type or stall alarm type, early detection and handling of abnormalities is possible. This protects the equipment and entire system from the risk of reduced air flow capacity and stalling due to unexpected troubles, increasing reliability.

#### Hard-to-service Environments

**[Examples of Hard-to-service Environments]**
- Equipment that is continuously operational and cannot be stopped
- Areas that are hard to enter
- Equipment that is delivered to and installed in remote locations
Selecting for Efficient Cooling

We recommend using different cooling fans based on the varying mounting density inside the equipment. Effective cooling is possible and improvements to energy savings and maintainability can be made at the same time.

The Relationship of Air Flow, Static Pressure, and Equipment Cooling Efficiency

The ideal cooling fan depends on the difference in installation density inside the equipment (air flow difficulty).

- High installation density
  - Significant pressure loss
  - Layout with internal structure and equipment that resists air flow, meaning that air cannot flow easily

- Low installation density
  - Low pressure loss
  - Internal structure and equipment do not resist air flow, meaning that air can flow easily

Efficient cooling is possible if a cooling fan with high static pressure is used for high installation density and a cooling fan with large air flow is used for low installation density.

Selecting a Cooling Fan Based on the Installation Density Inside the Equipment

Application Example with High Installation Density

Effective cooling is possible using a large cooling fan offering high static pressure. Using one large axial flow fan is more efficient than using multiple small axial flow fans. They are also suitable for use in equipment with high blower static, high duct air flow, and high installation density.

Applicable Products

AC Axial Flow Fans MRS Series ➜ Page F-32, MRE Series ➜ See website

Application Example of Equipment with Low Installation Density

Effective cooling is possible using a compact cooling fan offering a large air flow. Using two small cooling fans keeps noise levels and input current values lower than using one large cooling fan.

Applicable Products

AC Axial Flow Fans MU Series ➜ Page F-48
DC Axial Flow Fans MDS, MD Series ➜ Page F-56
DC Axial Flow Fans with Low-Speed Alarm MDA Series ➜ See website
Cooling Module FM Series

In environments where there is a danger of damage to equipment due to dust, insects, water, etc., we recommend the cooling module FM Series.

The cooling module FM Series enables longer life and improved reliability for the overall equipment. They also contribute to energy-saving and the environment preservation.

Points of Recommendation

- Longer overall equipment life
- Simplified equipment design
- Lower maintenance costs

Applicable Products

Cooling Module FM Series IP55/IP43 (Page F-105)
Resin hood type, IP55/IP43

Protects the inside of equipment from powdery dust and water droplets.
- Module dimensions: 209 mm × 226 mm – 129 mm × 134 mm (8.23 in. × 8.90 in. – 5.08 in. × 5.28 in.)

Example of installation of FM Series

"Fan and filter panels" that include a fan and a filter, and "filter panels" that include a filter, are available. Both exhaust type and suction type "fan and filter panels" are available, for a wide variety of applications.
Thermostat

We offer solutions to achieve proper temperature control in enclosures as well as an overall cost reduction through the combined use of a thermostat (AM1-WA1, AM1-XA1) and various AC fans.

Application Example of Thermostats

When the inside of the equipment is heated and reaches the thermostat's set temperature, the fans will start automatically. Once the inside of the equipment has cooled to a sufficient level, the fans will stop automatically.

Points of Recommendation

- Lower equipment noise
- Longer overall equipment life
- Lower power consumption
- Lower maintenance costs

Connection Example

Thermostat AM1-WA1/AM1-XA1

Features of Thermostats (AM1-WA1/AM1-XA1)

- Effective for energy-saving
- Lower equipment noise
- Easy setting
- No need for a separate power supply
- Conforms to DIN rail
- Conforms to safety standards
- Compact size: 33 mm (W) × 60 mm (H) × 35 mm (D) [1.30 in. (W) × 2.36 in. (H) × 1.38 in. (D)]
Fan Kit
Various accessories will help you improve the safety and utility of fans. We recommend our fan kits, which combine the fan and necessary accessories in convenient package.

Configuration of Fan Kit Products

- **MB Series Centrifugal Blowers**
  We offer the following accessories:
  - Finger Guards ➔ Page F-118
  - Filters ➔ Page F-120
  - Mounting Brackets ➔ Page F-125

  These accessories and mounting screws are supplied with the fan.

Diamond MB Series Fan Kit Products

- Centrifugal Blower MB1255-B and Accessories
  MB1255-B fan, finger guard FGB12 and mounting bracket PAS6A

- MB1255-B Fan Kit Product
  T-MB1255-B-GA
  Mounting screws are provided in addition to finger guard and mounting bracket.
  All necessary items are ordered at the same time, so you can start using the product immediately after delivery.
  Please specify T-MB1255-B-FA for use with filter FLB12.

Types of Fan Kit Products

- **AC Axial Flow Fans**
  - MRS Series fan kit* ➔ Page F-32—F-47
  - MU Series fan kit* ➔ Page F-48—F-55

- **DC Axial Flow Fans**
  - MDS, MD and MDE Series fan kit ➔ Page F-56—F-77

- **AC Centrifugal Blowers, DC Centrifugal Blowers**
  - MB and MBD Series fan kit ➔ Page F-82—F-99

  *Filter is included with some products of the MRS Series fan kit.
  Plug cords are not supplied with the fan kit products of the MRS Series and the MU825 types.
How to Read Specifications

Specifications Table (Example) MRS Series/□ 200 mm – 90 mm Thick (□ 7.87 in. – 3.54 in. Thick)

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage</th>
<th>Frequency</th>
<th>Current</th>
<th>Input</th>
<th>Speed</th>
<th>Max. Air Flow</th>
<th>Max. Static Pressure</th>
<th>Noise Level</th>
<th>Capacitor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VAC</td>
<td>Hz</td>
<td>A</td>
<td>W</td>
<td>r/min</td>
<td>m³/min/CFM</td>
<td>Pa</td>
<td>dB (A)</td>
<td>μF</td>
</tr>
<tr>
<td>MRS20-BM</td>
<td>Single-Phase 100</td>
<td>50</td>
<td>0.8</td>
<td>75</td>
<td>2850</td>
<td>13.2</td>
<td>466</td>
<td>221</td>
<td>0.886</td>
</tr>
<tr>
<td>MRS20-BUL</td>
<td>Single-Phase 100</td>
<td>60</td>
<td>1.0</td>
<td>95</td>
<td>3350</td>
<td>15.5</td>
<td>547</td>
<td>196</td>
<td>0.746</td>
</tr>
<tr>
<td></td>
<td>Single-Phase 110</td>
<td>60</td>
<td>1.0</td>
<td>95</td>
<td>3400</td>
<td>15.5</td>
<td>547</td>
<td>255</td>
<td>1.02</td>
</tr>
<tr>
<td></td>
<td>Single-Phase 115</td>
<td>60</td>
<td>1.0</td>
<td>95</td>
<td>3400</td>
<td>15.5</td>
<td>547</td>
<td>265</td>
<td>1.06</td>
</tr>
<tr>
<td>MRS20-DM</td>
<td>Single-Phase 200</td>
<td>50</td>
<td>0.4</td>
<td>75</td>
<td>2850</td>
<td>13.2</td>
<td>466</td>
<td>221</td>
<td>0.886</td>
</tr>
<tr>
<td>MRS20-DUL</td>
<td>Single-Phase 200</td>
<td>60</td>
<td>0.5</td>
<td>95</td>
<td>3350</td>
<td>15.5</td>
<td>547</td>
<td>196</td>
<td>0.746</td>
</tr>
<tr>
<td></td>
<td>Single-Phase 230</td>
<td>60</td>
<td>0.5</td>
<td>95</td>
<td>3400</td>
<td>15.5</td>
<td>547</td>
<td>265</td>
<td>1.06</td>
</tr>
<tr>
<td>MRS20-TM</td>
<td>Three-Phase 200</td>
<td>50</td>
<td>0.4</td>
<td>75</td>
<td>2850</td>
<td>13.2</td>
<td>466</td>
<td>221</td>
<td>0.886</td>
</tr>
<tr>
<td>MRS20-TUL</td>
<td>Three-Phase 200</td>
<td>60</td>
<td>0.4</td>
<td>95</td>
<td>3350</td>
<td>15.5</td>
<td>547</td>
<td>196</td>
<td>0.746</td>
</tr>
<tr>
<td></td>
<td>Three-Phase 230</td>
<td>60</td>
<td>0.4</td>
<td>95</td>
<td>3400</td>
<td>15.5</td>
<td>547</td>
<td>265</td>
<td>1.06</td>
</tr>
</tbody>
</table>

1 Voltage: Power supply voltage needed to operate the fans. Varies with the type of fan, single-phase 100 VAC, 110 VAC, 115 VAC, single-phase 200 VAC, 220 VAC, 230 VAC and three-phase 200 VAC, 220 VAC, 230 VAC for AC power supply, and 5 VDC, 12 VDC, 24 VDC, 48 VDC for DC power supply.
2 Frequency: For AC fans, speed varies depending on the frequency.
3 Current: The current when the fan is at rated speed.
4 Input Power: The input power when the fan is at rated speed.
5 Speed: The fan’s rated speed.
6 Max. Air Flow: Maximum air flow that the fan can produce at rated speed.
7 Max. Static Pressure: Maximum static pressure that the fan can produce at rated speed.
8 Noise Level: Noise level when the fan is at rated speed.
9 Capacitor: Capacitor is required to operate single-phase 100 VAC, 110 VAC, 115 VAC and single-phase 200 VAC, 220 VAC, 230 VAC fans (Capacitor is included or built-in with products).
10 Alarm Specifications: Indicate the type of fan with alarm.

Overheat Protection
- Built-in thermal protector
  If the fan overheats and the internal temperature of windings reaches the specified temperature, the thermal protector (automatic return type) is activated and the fan is stopped. Be sure to turn the fan off before inspecting.
- Impedance protected
  These products are impedance protected to prevent the windings from burning.
- Built-in overheat protection circuit
  Overheat protection circuit is installed to prevent the windings from burning.

Fan Operation
Do not touch the fan blades when the fan is in operation. Use a finger guard (accessory) for protection.
(A convenient fan kit is also available. → Page F-18)
How to Read Air Flow – Static Pressure Characteristics

The air flow – static pressure characteristics diagram indicates the static pressure value for a given air flow, with air flow on the horizontal axis and static pressure on the vertical axis.

In the diagram below, an air flow of 13.2 m³/min (466 CFM) (at 50 Hz) corresponds to a condition with no pressure loss [static pressure 0 Pa (0 CFM)], which is the air flow value the fan can produce (maximum air flow).

Also, a static pressure of 221 Pa (0.886 inH₂O) (at 50 Hz) is the maximum static pressure the fan can produce.

For details, refer to page G-83 in technical reference.
Specifications for Fans with Alarms

The alarm specifications vary depending on the type of alarm and fan. Check the alarm specifications according to the alarm and fan type you use. Specifications can also be referred to by the alarm specifications number shown on the specifications for each product.

### Stall Alarm, Electronic Alarm Type

An alarm is output when the fan stops while operating.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm Activation Speed</td>
<td>When locked</td>
<td></td>
</tr>
<tr>
<td>Output Mode</td>
<td>Open-collector output</td>
<td></td>
</tr>
</tbody>
</table>
| Output Condition | Operation: L level (Internal transistor ON)  
Alarm output: H level (Internal transistor OFF) |
| Maximum Rating | Maximum applied voltage: 30 VDC max.  
Maximum current: 5 mA max. |
| Delay Function | Not built-in: External delay circuit is required to prevent alarm detection when starting the fan. The delay time should be at least 1 second. |

#### Example of Alarm Circuit Connection

- **Yellow** or **Orange**
- **Black**
- Fan
- **30 VDC max.**
- **5 mA max.**
- **0 V**
- **Controller**

### Low-Speed Alarm, Electronic Alarm Type

An alarm is output when the fan speed drops to a specific level. Output mode is electronic output.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm Activation Speed</td>
<td>1800±300 r/min</td>
<td></td>
</tr>
<tr>
<td>Output Mode</td>
<td>Open-collector output</td>
<td></td>
</tr>
</tbody>
</table>
| Output Condition | Normal operation: L level (Internal transistor ON)  
Alarm output: H level (Internal transistor OFF) |
| Maximum Rating | Maximum applied voltage: 30 VDC max.  
Maximum current: 15 mA max. |
| Delay Function | Not built-in: External delay circuit is required to prevent alarm detection when starting the fan. The delay time should be at least 10 seconds. |

#### Example of Alarm Circuit Connection

- **Orange**  
- **Blue**  
- **Fan**  
- **30 VDC max.**  
- **15 mA max.**  
- **0 V**  
- **Controller**

### Warn Alarm, Electronic Alarm Type

An alarm is output when the fan speed drops to a specific level. Output mode is electronic output.

<table>
<thead>
<tr>
<th>Models</th>
<th>MRS Series: MRS14-TTM</th>
<th>Alarm Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm Activation Speed</td>
<td>1800±300 r/min</td>
<td></td>
</tr>
<tr>
<td>Output Mode</td>
<td>Open-collector output</td>
<td></td>
</tr>
</tbody>
</table>
| Output Condition | Normal operation: L level (Internal transistor ON)  
Alarm output: H level (Internal transistor OFF) |
| Maximum Rating | Maximum applied voltage: 30 VDC max.  
Maximum current: 15 mA max. |
| Power Supply for Driving Alarm Circuit | 5 VDC ±5% |
| Delay Function | Built-in starting delay time: 25 sec. max.  
(The alarm function starts monitoring within 25 seconds after the power is turned on.) |

#### Example of Alarm Circuit Connection

- **Red**  
- **5 VDC**  
- **Orange**  
- **Black**  
- **Fan**  
- **30 VDC max.**  
- **15 mA max.**  
- **0 V**  
- **Controller**

### Warn Alarm, Electronic Alarm Type

An alarm is output when the fan speed drops to a specific level. Output mode is electronic output.

<table>
<thead>
<tr>
<th>Models</th>
<th>MDS Series: MDS1225-MH, MDS1225-M</th>
<th>Alarm Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm Activation Speed</td>
<td>2100±400 r/min</td>
<td></td>
</tr>
<tr>
<td>Output Mode</td>
<td>Open-collector output</td>
<td></td>
</tr>
</tbody>
</table>
| Output Condition | Normal operation: L level (Internal transistor ON)  
Alarm output: H level (Internal transistor OFF) |
| Maximum Rating | Maximum applied voltage: 30 VDC max.  
Maximum current: 15 mA max. |
| Delay Function | Built-in starting delay time: 10 sec. max.  
(The alarm function starts monitoring within 10 seconds after the power is turned on.) |

#### Example of Alarm Circuit Connection

- **Orange**  
- **Blue**  
- **Fan**  
- **30 VDC max.**  
- **15 mA max.**  
- **0 V**  
- **Controller**
Low-Speed Alarm, Contact Alarm Type

An alarm is output when the fan speed drops to a specific level. Output mode is contact output.

### Models: MRS Series: MRS25-□B

#### Alarm Specifications

<table>
<thead>
<tr>
<th>Alarm Specifications Number</th>
<th>Alarm Activation Speed</th>
<th>Output Mode</th>
<th>Output Condition</th>
<th>Maximum Rating</th>
<th>Delay Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1800 ± 300 r/min</td>
<td>Relay output</td>
<td>Normal operation: Contact ON</td>
<td>Resistive load: max. 10 VA (max. 100 V / max. 0.5 A)</td>
<td>Not built-in: External delay circuit is required to prevent alarm detection when starting the fan. The delay time should be at least 10 seconds.</td>
</tr>
</tbody>
</table>

### Example of Alarm Circuit Connection

- **White**: Fan
- **Black**: Controller
- **30 V**: Voltage

### Models: MRS Series: MRS16-□TA

#### Alarm Specifications

<table>
<thead>
<tr>
<th>Alarm Specifications Number</th>
<th>Alarm Activation Speed</th>
<th>Output Mode</th>
<th>Output Condition</th>
<th>Maximum Rating</th>
<th>Delay Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1800 ± 300 r/min</td>
<td>Relay output</td>
<td>Normal operation: Contact OFF</td>
<td>Resistive load: max. 10 VA (max. 100 V / max. 0.5 A)</td>
<td>Not built-in: External delay circuit is required to prevent alarm detection when starting the fan. The delay time should be at least 10 seconds.</td>
</tr>
</tbody>
</table>

### Example of Alarm Circuit Connection

- **White**: Fan
- **Black**: Controller
- **30 V**: Voltage


#### Alarm Specifications

<table>
<thead>
<tr>
<th>Alarm Specifications Number</th>
<th>Alarm Activation Speed</th>
<th>Output Mode</th>
<th>Output Condition</th>
<th>Maximum Rating</th>
<th>Delay Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MBD10-24A, MBD8-24A: 1500 ± 400 r/min</td>
<td>Relay output</td>
<td>Normal operation: Contact ON</td>
<td>Maximum applied voltage: 30 VDC max. Maximum current: 30 mA max.</td>
<td>Built-in starting delay time: 10 sec. max. (The alarm function starts monitoring within 10 seconds after the power is turned on.)</td>
</tr>
</tbody>
</table>

### Example of Alarm Circuit Connection

- **White**: Fan
- **Blue**: Controller
- **30 mA max.**: Current
- **30 VDC max.**: Voltage

### Models: MDS Series: MDS1751-24BH, MDS1751-24B

#### Alarm Specifications

<table>
<thead>
<tr>
<th>Alarm Specifications Number</th>
<th>Alarm Activation Speed</th>
<th>Output Mode</th>
<th>Output Condition</th>
<th>Maximum Rating</th>
<th>Delay Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1800 ± 400 r/min</td>
<td>Relay output</td>
<td>Normal operation: Contact ON</td>
<td>Maximum applied voltage: 30 VDC max. Maximum current: 30 mA max.</td>
<td>Built-in starting delay time: 10 sec. max. (The alarm function starts monitoring within 10 seconds after the power is turned on.)</td>
</tr>
</tbody>
</table>

### Example of Alarm Circuit Connection

- **White**: Fan
- **Blue**: Controller
- **30 mA max.**: Current
- **30 VDC max.**: Voltage
**Pulse Sensor Type**

Two pulses are output per revolution of the fan. Fan speed is monitored as the host controller, etc., reads the output pulses. This function helps you set a desired output speed for alarm activation.

### Models
- **MDS/MD Series:** MDS1751-24SH, MDS1751-24S, MD925A-□SH, MD925A-□S, MD825□SH, MD825□S, MDS1751-24SH, MDS1751-24S, MD925□SH, MD925□S, MD825□SH, MD825□S
- **MBD Series:** MBD□-□SH, MBD□-□S

### Alarm Specifications

<table>
<thead>
<tr>
<th>Output Pulse</th>
<th>Two pulses per fan revolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Mode</td>
<td>Open-collector output</td>
</tr>
</tbody>
</table>

- **Normal Operation**
  - $V_{OH} = 0$ V
  - $V_{OL} = 0$ V
  - $T = T_1 + T_2 + T_3 + T_4$

- **When Locked**
  - $V_{OH} = 0$ V
  - $V_{OL} = 0$ V
  - $T = T_1 - T_2 - T_3 - T_4$

One fan revolution

$$T = T_1 - T_4 = \frac{60}{N} \text{ (N: Speed [r/min])}$$

Pulse width duty $= \frac{T_1 + T_2}{T_1 + T_2} = 50 \pm 10\%$

### Maximum Rating
- Maximum applied voltage: 30 VDC max.
- Maximum current $I_c$:
  - MD925□-□SH, MD925□-□S, MD825□-□SH, MD825□-□S: 5 mA max.

#### Example of Alarm Circuit Connection

- Yellow
- Black
- Fan
- GND
- Controller

$5 \text{ V}$

$$T_1 + T_2 = 50 \pm 10\%$$

$\text{VOH}$

$\text{VOL}$

$0 \text{ V}$

$30 \text{ VDC max}$

$5 \text{ mA max}$

---

### Models
- **MDS Series:** MDS1451-□SH, MDS1451-□S

<table>
<thead>
<tr>
<th>Output Pulse</th>
<th>Two pulses per fan revolution</th>
</tr>
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- **Normal Operation**
  - $V_{OH} = 0$ V
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  - $T = T_1 + T_2 + T_3 + T_4$

- **When Locked**
  - $V_{OH} = 0$ V
  - $V_{OL} = 0$ V
  - $T = T_1 - T_2 - T_3 - T_4$

One fan revolution

$$T = T_1 - T_4 = \frac{60}{N} \text{ (N: Speed [r/min])}$$

Pulse width duty $= \frac{T_1 + T_2}{T_1 + T_2} = 50 \pm 10\%$

### Maximum Rating
- Maximum applied voltage: 30 VDC max.
- Maximum current: 5 mA max.

#### Example of Alarm Circuit Connection

- Yellow
- Black
- Fan
- GND
- Controller

$5 \text{ V}$

$$T_1 + T_2 = 50 \pm 10\%$$

$\text{VOH}$

$\text{VOL}$

$0 \text{ V}$

$30 \text{ VDC max}$

$5 \text{ mA max}$