

# AoFrio

USER MANUAL

# ECR2 26W Installation & operation

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## Table of contents

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<b>Warnings</b>	<b>3</b>
<b>Dimensions</b>	<b>5</b>
<b>Installation</b>	<b>6</b>
<b>Motor mounting</b>	<b>6</b>
<b>Fan installation</b>	<b>8</b>
<b>Fan speed</b>	<b>9</b>
<b>Electrical connections</b>	<b>10</b>
<b>Motor configuration</b>	<b>10</b>
<b>Preset and programable behaviors</b>	<b>11</b>
<b>Operation examples</b>	<b>12</b>
<b>Integrated protection features</b>	<b>13</b>
<b>Low voltage behavior</b>	<b>13</b>
<b>Troubleshooting</b>	<b>14</b>
<b>Maintenance and cleaning</b>	<b>15</b>
<b>Specifications</b>	<b>16</b>
<b>Conformity with standards</b>	<b>17</b>

## Warnings

Please read the following warnings to maintain the safe function and continued performance of your Wellington ECR2 26W motor:

### Accuracy of information and disclaimer of warranties

All technical advice furnished, or recommendations made in this document are provided in good faith and are believed to be accurate as at the date of publication. However, your use of this document is at your sole risk.

Neither AoFrio nor its related bodies corporate nor its or their directors' officers and employees (together "AoFrio") make any warranty, expressed or implied, in relation to the reliability, accuracy or completeness of any information in this document or as to any results to be obtained. The buyer assumes all responsibility for loss or damage resulting from the use of this document or the handling or use of any of the products.

AoFrio's products are supplied under the terms and conditions contained in the General Conditions of Sale which can be viewed at [www.aofrio.com](http://www.aofrio.com).


### General Safety

- Only install or maintain electric motors and fans if you are suitably qualified and trained.
- Wear suitable safety clothing and use appropriate equipment to avoid injury.
- Inspect the motor, housing, and other mechanical parts such as cables and connections for damage and defects before installing. Do not install the motor if it is damaged or if it has been dropped.
- Check electrical cables and connections for damage at regular intervals. Remove defective motors.
- Do not install cables in a way that will allow them to come into contact with a fan.
- As the motor does not contain any serviceable parts, please return, or responsibly dispose of, damaged or malfunctioning motors.
- After a fan has been attached to the motor, take care to avoid injury from spinning fan blades. Avoid wearing loose clothing and jewelry and use a hair net.
- Do not work on the machine while the fan is still spinning.
- Install a suitable guard over the fan to avoid accidental contact with spinning fan blades.
- As the motor can start automatically and unexpectedly when power is applied, do not assume that a non-rotating motor is not powered. Always check that power is disconnected before you work on the motor or fan.
- After a period of operation, some motor surfaces may be hot. Ensure there is protection from accidental contact to avoid burn injuries.

### Wires and cords

- Ensure all wires and cords are routed and supported to reduce the risk of damage from:
  - Sharp edges
  - Surfaces and parts that operate at temperatures higher than the wire insulation's specified range
  - Moving parts
  - Motors, motor compressors, refrigerant lines, and similar parts that are likely to vibrate
  - Clamps without smooth, rounded surfaces
  - Metal parts contacting single insulated wiring

## Zone 2 Flammable Gas Environments

- If you are installing a motor in a Zone 2 Flammable Gas Environment, check that it is suitably certified. Only motors carrying the  mark are certified for use in zone 2 flammable gas environments.
- Check that all electrical connections to the motor and electrical cable conform to the ATEX Directive 2014/34/EU and IEC 60079-0.
- Enclose any fan attached to the motor with fan hood, or enclosure, to provide IP20 on the air inlet side and IP10 at the air outlet side. This fan motor should be installed completely within an enclosure that provides a degree of protection in accordance with IEC/EN 60079-0.
- Check the clearances between the fan and its hood or walls of the enclosure are at least 1/100 of the maximum diameter of the fan, or 2mm (whichever is greater). Clearances must not exceed 5 mm.
- If the installed fan is made of light alloy, the content of Mg and Ti must be less than 7.5%.
- Check that the fan complies with EN 14986, EN 13463-1, EN 13463-5 (or EN 80079-36, EN 80079-37) for the EU market. Installation must comply with IEC 60079-0 and IEC 60079-15.
- To minimize the risk of electrostatic charging, clean with a damp cloth only or touch with an insulating object.

## Proper use

The ECR motor range is designed to be used exclusively as fan motors in commercial refrigeration applications. This means:

- Motors must be properly matched to the required fan load. See AoFrio's product range for performance data.
- The rated load of the motor shall not be exceeded.
- Motors must only be used in environments that are within the specified permitted temperature limits.
- Motors must only be used within the limits of their respective IP ratings.
- Motors shall not be used in situations where they will be partially or wholly submerged in water.
- In order to maintain the motor IP rating (IP67) the motor connectors should be IP67-rated or the connectors appropriately located or protected so that they are not subject to moisture or humidity.
- ECR2 should not be used in conjunction with transformer type voltage stabilizers with maximum boost ratio of 1.4 or higher in 230 Volt applications.

### Warning: Compliance Responsibility

The responsibility for evaluating the suitability of the ECR2 in any end product system, in accordance with all relevant regulations and standards, rests with the end product system manufacturer.

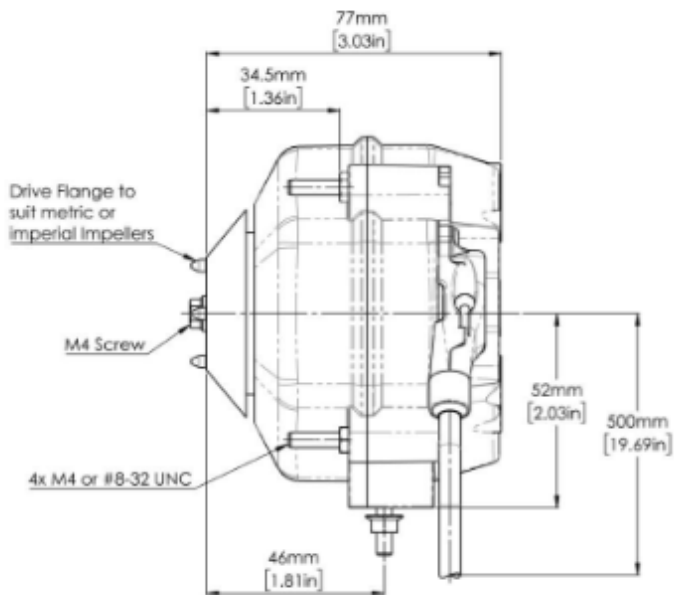
## Transport and Handling

- Storage – Store motors in clean, dry conditions.
- Motor handling – Take care to protect motors from damage caused by impact or dropping during transport.
- Disposal – Follow the regulations for disposal of electrical equipment in the country of use.

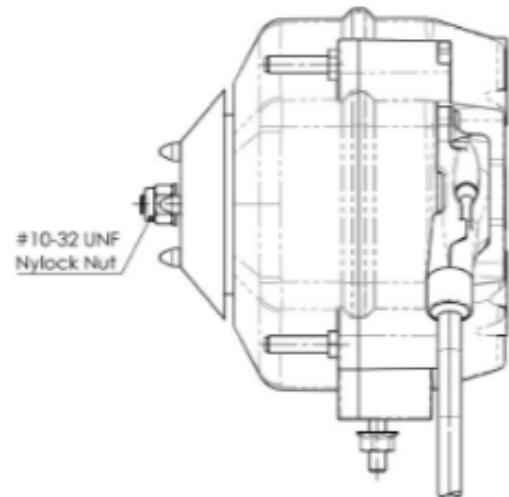
## Cleaning

- WARNING – Electrical shock or burn hazard. Unplug the unit or turn off the power supply before proceeding.
- DO NOT clean the motor with a pressure washer or hose.

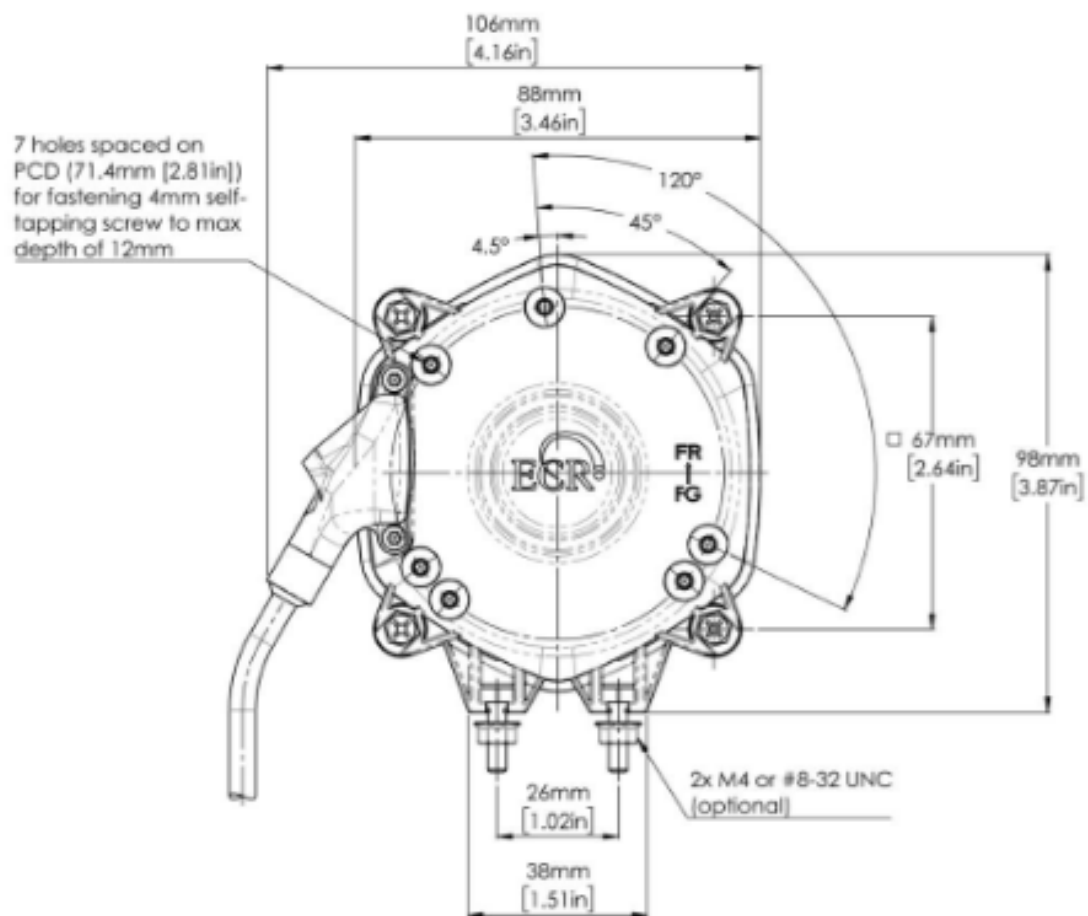
## Dimensions



Side view of internal threaded shaft motor



Side view of external threaded shaft motor



Rear view (both shafts)

## Installation

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The following general requirements must be met for any installation of the motor:

- Install the motor in such a way as to protect it from any impact sources.
- Do not remove or loosen the nuts for the 'through bolts' as this can damage the seal between the motor housings.
- Either use flanged hex head nut with serrations or use standard nuts along with spring to fasten the motor to its mounting.
- Secure cables and wiring to avoid contact with moving parts and fan blades.
- Install cables in a way that does not put excessive strain on the cable gland.
- Mount motors in an orientation that allows cable entry from underneath or below the motor as shown below in Figure 1. If cable orientation is from the side of the motor, you should apply a downward bend to the cable as close to the cable gland as possible to avoid water tracking into the motor. Cable entry from above is not recommended.

## Motor mounting

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Motors can be mounted either as Basket or ring, Bracket, or Rear.

### Basket or Ring Mounting

Secure the motor to the fan basket with four flanged nuts, or nuts and spring washers, with a required torque setting of 1.0 - 1.5Nm.

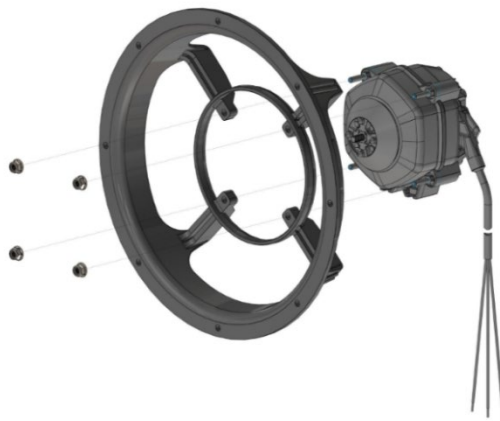


Figure 1: Fan basket or ring mount

### Bracket Mount

Secure the motor to the bracket with two screws which are part of the Foot Mount Kit. Then insert the rectangular washers and screws into the foot mount feature on the housing (see Figure 2) making sure that you push the screws all the way to the end of the groove.

Figure 3 shows the correct assembly of the motor to a foot mount bracket. The required torque setting for the two hex nuts is 2.0 – 2.2Nm.

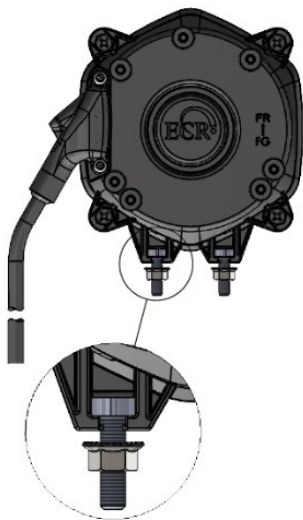


Figure 2. – Foot Mount Kit Insertion

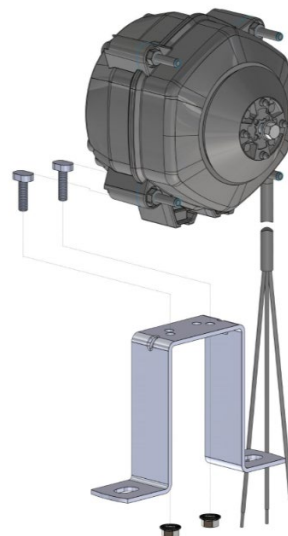


Figure 3. – Bracket assembly

### Rear Mount

NOTE: You should only use AoFrio supplied screws for this mounting option.

To rear mount a motor to a bulkhead or a sheet metal bracket, secure them with either 3 or 4 plastite screws. As shown in Figure 4, below, screws may not have a penetration of more than 12mm. The required torque setting for the rear mount screws is 2.5-3.0Nm.



Figure 4. – Rear Mounting Screw

## Fan installation

NOTE: Only use AoFrio supplied washers, screws and nuts for installation of the axial impeller.

Use a flat washer, or conical washer, between the fan and the serrated flange screw when assembling to an internal thread shaft.

In the same way, use a flat or conical washer between the impeller and nut when assembling to the external thread shaft.

Figures 5a and 5b show the correct assembly of a fan to the motor.

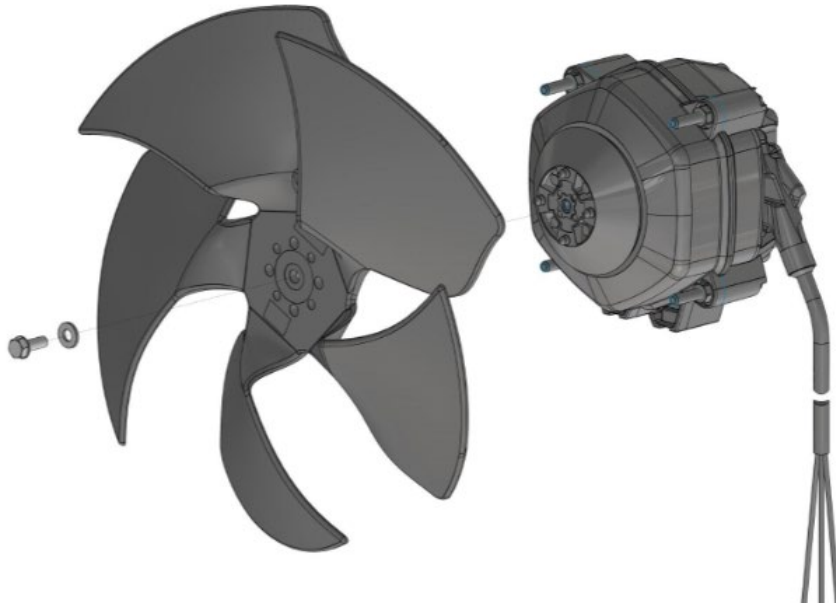


Figure 5a. – Fan Assembly (Internal thread shaft) Torque Setting: 1.5 – 1.7N.m

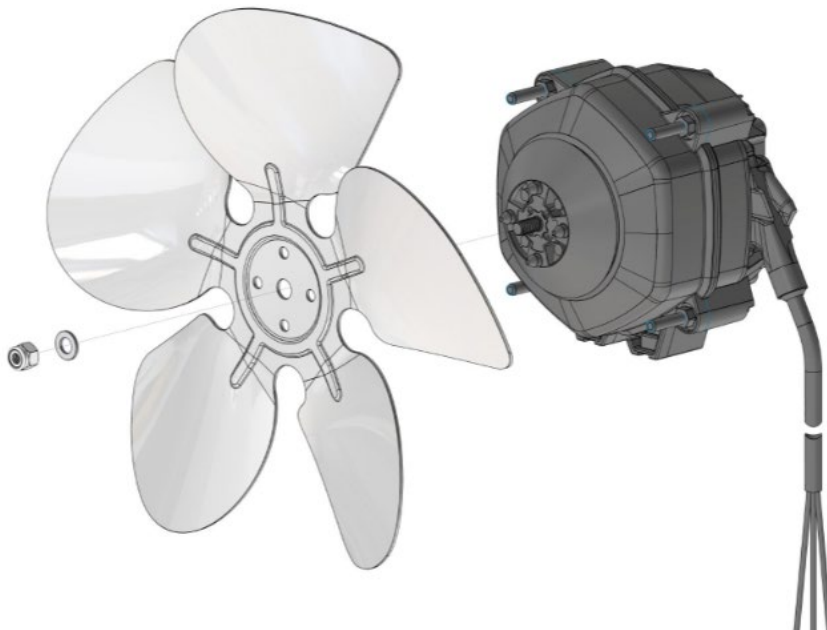


Figure 5b – Fan Assembly (external thread shaft) Torque Setting: 3.0 – 3.2N.m

# Fan speed

Suitable Fans							
Speed	200mm (8")	230mm (9")			254mm (10")		
	34°	22°	28°	34°	22°	28°	34°
1300 rpm	+	+	+	+	+	+	+/-
1550 rpm	+	+	+	+	+	+	-
1800 rpm	+	+	+	-	+	+/-	-
2100 rpm	+	+	+/-	-	+/-	-	-

+

 Achieve rated rpm

-

 Does not achieve rated rpm

+/-

 May not achieve rated rpm at all back pressures

## Electrical connections



### WARNING

The black wire should be treated as a Live part. Ensure that appropriate electrical separation is maintained.

In order to maintain the motor IP rating (IP67) the motor connectors should be IP67 rated or the connectors appropriately located or protected so that they are not subject to moisture or humidity.

The supply cord and its connector are specific to the end product installation and needs to be reviewed and addressed as part of the end product assessment.

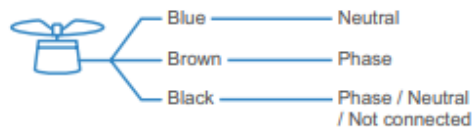
If the motor is being used in a potentially explosive environment, electrical connections must be made and protected in accordance with relevant ATEX/IECEX standards (see section 1.2 Safety in Zone 2 Flammable Gas Environments).

Connect conductors as follows:

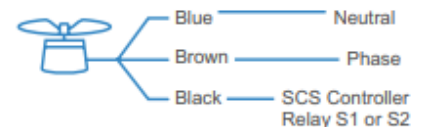
#### For single speed operation



#### For three speed or reversible operation



#### For variable speed operation



## Motor configuration

The ECR2 motor has smart control features which provide a range of programmed speed, direction and timed behaviors, these are typically preset by AoFrio, but may also be field-programmed. When used in conjunction with an AoFrio SCS Controller the speed and direction can be varied by the SCS.

Talk to our AoFrio representative about the motor configuration that works best for you.

### Preset operation functions

Your AoFrio representative will assist to develop the preset behaviors of the motor or refer to respective connection diagram and product labels on motors for Direction of Rotation behaviors. See the section Programable behaviors for available functions.

### On demand programming

The preset behaviours may be changed using AoFrio's Universal Programmer software and hardware (UNIPROG) in the field or OEM factory.

### Variable Speed operation

When wired to the S1 or S2 output of an AoFrio SCS Controller, both speed and direction of the ECR2 can be controlled. The speed range is from 500-2300rpm in 10 rpm increments.

# Preset and programable behaviors

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## Control wire states

Motors with the black control wire (three wire motors) have three valid states. If you change these states, you will change the operation of the motor. The three states are:

- Black wire not connected (to phase or Neutral)
- Black wire connected to Phase
- Black wire connected to Neutral

You can change the black control wire connection at any time.

You can also configure motors without the black control wire (2 wire motors), however they only have one state.

Each of the following functions start either when the cooler powers on, or after a change in the control wire state.

## Operating functions

Each control wire state/ polarity can have a speed, direction and an optional timer assigned (Step 1) .

When the timer is enabled a second set of speed and direction can be assigned (Step2).

## Sequence

### Step1:

- When the control wire changes polarity (i.e the control wire is switched from Phase to Neutral), or when the motor is first power on, the speed and direction assigned to step 1 are used.
- If the timer is disabled, the motor will operate in Step 1 continuously.
- If the timer is enabled the motor will automatically switch to step2 when the timer stops

### Step2:

- The motor will use the second set of speed and direction assigned to step 2
- The motor will continue to operate in this step until the control wire state is changed or the motor is powered off.

## Speeds function

The motor speed can be set from 300 – 2300rpm.

The motor can also be assigned to Stop ( 0 speed) – this is generally used in conjunction with the timer function.

## Direction function

The direction of rotation can also be set to either CW (clockwise) or CCW ( Counterclockwise). The direction is observed from the drive end of the motors where the fan connects.

## Timer function (optional)

When using the Timer function, you can set the motor to run from 0 seconds up to 3600 seconds (1Hour) with the programed speed and directions assigned to step1

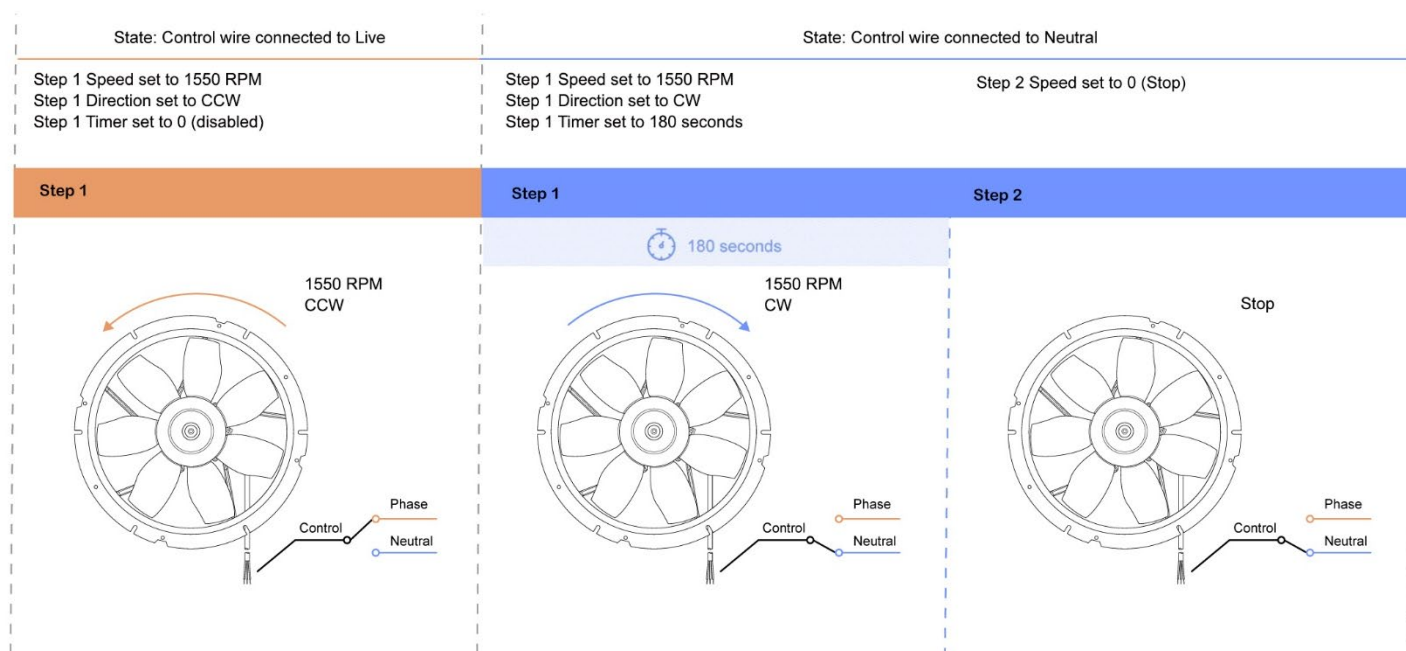
- If the timer is set to 0 seconds, the timer is disabled, and step 2 is disabled.
- If the timer is set from 1-3600 seconds, then the step 1 timer is enabled

## Operation examples

### Example A - Timed reverse

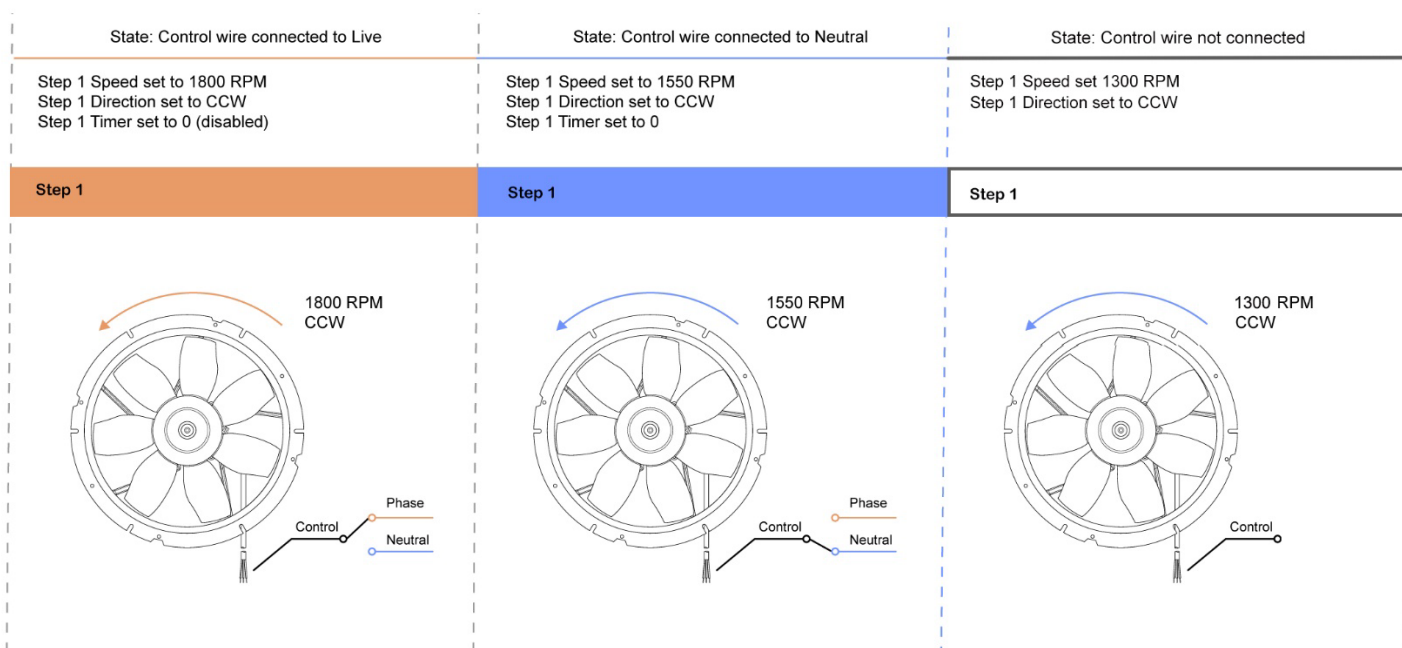
When the control wire is connected to Phase, the fan is set to run counterclockwise continuously.

When the control wire is connected to Neutral, the motor is set to run clockwise for 180 seconds and stop



### Example B – Three-speed

When the control wire is connected to Phase, the fan is set to run counterclockwise continuously at 1800 rpm. When the control wire is connected to Neutral, the fan is set to run counterclockwise at 1550 rpm. When the Control wire is not connected to either Phase or Neutral the fan is set to 1300 rpm.



## Integrated protection features

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The ECR2 26 motor is designed to continue operating even under overload situations. When an overload is identified, the motor does not cease operation. Instead, it adjusts the set speed of the motor until the torque, power, or temperature fall within acceptable boundaries. This adjustment is achieved through three specific methods:

Protection mechanism	Criteria	Behaviour function
Locked rotor	If the rotor is locked	Motor will attempt to restart every 10 seconds until the blockage is removed.
Torque Constraint	Required torque exceeds 0.14Nm and set speeds less than 1800rpm	Motor speed will reduce until torque equals 0.14Nm.
Power constraint	Required power output higher than 26W	Motor Speed will reduce until power equals 26W.
Speed constraint	The maximum speed is 2300 rpm	The motor speed cannot exceed 2300rpm.
Temperature constraint	Internal motor temperature exceeds thermal limit. At full power (26W) or full torque (0.14Nm), the thermal limit will activate at roughly 45°C external ambient.	Motor speed will reduce until internal temperature is below the limit.

## Low voltage behavior

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The ECR2 26W motor is designed to operate with nominal power supply voltages ranging from 100 to 240Vac. To ensure proper motor function, the supply voltage is continuously monitored, and motor performance is adjusted accordingly.

The ECR2 26W will maintain performance over a wide range of input supply voltages, however there is a derating for supply voltages below 110Vac. If the input voltage falls below 110Vac, the maximum output power is reduced to less than 26 watts. The motor requires 85Vac to guarantee starting under all conditions, however it will continue to operate at voltages below 85Vac once started.

## Troubleshooting

Issue	Possible Cause	Action
Motor pauses in the first few seconds of starting	This is normal behaviour for this type of motor and is not a fault condition.	None.
Motor does not turn	No mains power.	Check the mains power supply is connected and switched on.
	Faulty connection.	Check power cable connection for damage and faults.
	Thermal protection activated.	Allow motor to cool down and thermal protection to reset.
	Reverse function timed out	Change motor state by changing the polarity of the control wire.
Motor fails to start after multiple attempts or stops and starts often.	Fan diameter or pitch too large.	Reduce load on motor.
Motor runs at slower speed than configured.	Fan diameter or pitch too large. The motor is either in torque, power or thermal limit.	Reduce load on motor.
Motor runs in wrong or opposite direction	Black control wire not connected properly.	Check the connection of the black control wire connection.

## Maintenance and cleaning

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We recommend that you set up a regular maintenance schedule for your cooler as follows. At least every six months, check that:

- Cables are not showing breakage or wear
- Fan is not damaged and is fastened correctly
- Fan guard is still in place
- Motor is still securely mounted.

### Cleaning

- When cleaning the motor and fan, we recommend using a soft cloth and non-abrasive cleaning fluid to remove dirt, dust, and other matter from the exterior. Avoid using sharp objects and alkali, acid, and solvent-based fluids that may damage the device.
- Never open the device to clean inside.
- Never clean using high-pressure water blasting or jetting as this can damage sensitive components.

### Motor repair

- The motor does not contain any user serviceable parts and cannot be repaired.
- The motor bearings are selected for the rated duty of the motor and are expected to last for the life of the motor.
- If the motor no longer functions properly, follow the regulations for disposal of electrical equipment in the country where it is being used.

### Service / Technical Support

- For servicing or technical support, please contact your local AoFrio Sales Office or find your nearest contact by visiting [www.aofrio.com](http://www.aofrio.com).

## Specifications

### Environment

<b>Operating Temperature Range</b>	-30 to +50°C -22 to +122°F
<b>Storage Temperature Range</b>	-40 to +80°C -40 to +176°F

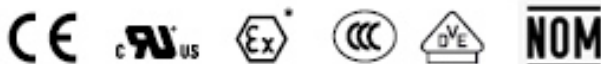
### General Ratings

<b>Nominal voltage</b>	100-240 VAC , 50-60Hz
<b>Frequency</b>	50-60 Hz
<b>Output Power Range</b>	0-26W
<b>Speed range</b>	300-2300 RPM

### Technical description

<b>Weight</b>	0.69Kg (1.5 lb)
<b>Housing material</b>	PA plastic
<b>Direction of rotation</b>	CCW or CW
<b>Speeds</b>	3
<b>Functions</b>	Configurable
<b>Insulation class</b>	B
<b>Degree of protection</b>	IP67
<b>Installation position</b>	Any
<b>Motor bearing</b>	Ball bearing
<b>Technical features</b>	<ul style="list-style-type: none"><li>• Variable speed</li><li>• Configurable speed, direction, timed behavior</li><li>• Overload protection</li></ul>

#### Approvals



\* Ex approvals pending

## Conformity with standards

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- IEC 60335-2-80:2015 in conjunction with IEC 60335-1:2010, COR1:2010, COR2:2011, AMD1:2013, AMD2:2016.
- EN 60335-1:2012/A11:2014/A13:2017/A1:2019/ A2:2019/A14:2019/A15:2021
- EN 60335-2-80:2003+A1:2004+A2:2009
- EN 62233:2008 + AC:2008
- AS/NZS 60335.1:2020 + A1:2021
- AS/NZS 60335.2.80: 2016 + A1:2020 + A2:2022
  
- IEC 60335-2-89:2019 for use in conjunction with IEC 60335-1:2010, COR1:2010, COR2:2010, AMD1:2013, COR1:2014, AMD2:2016, COR1:2016.
- EN IEC 60335-2-89:2022 + A11:2022
- EN 60335-1:2012 + A11:2014 + A13:2017 + A1:2019 + A14:2019 + A2:2019 + A15:2021
- EN 62233:2008
- AS/NZS 60335.2.89:2020
- AS/NZS 60335.1:2020+A1:2021
  
- EN 55014-1:2017/A11:2020
- EN 55014-2 : 2021

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