



**EVERGREEN • EM  
INSTALLATION GUIDE**



A Regal Brand





Genteq's Evergreen EM is designed to replace OEM X13 ECM motors quickly and easily – with no programming required. Evergreen EM provides the same comfort, lower utility bills and air quality as the OEM X13 ECM motor, with less hassle for you. With Evergreen EM, increasing your bottom line just got a little easier. For more information on all Genteq products please visit [genteqmotors.com](http://genteqmotors.com).

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Fort Wayne, IN 46818  
1-866-503-8566  
[thedealertools.com](http://thedealertools.com)



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**Please read the entire instruction manual  
before starting the installation.**



## Safety Considerations

The following safety warning symbol is used throughout this manual as a safety consideration for installation and operation of the Evergreen EM motor. This warning indicates a hazardous situation which, if not avoided, could result in serious injury or death. Please read and observe all of these safety concerns.

 **WARNING**

Installation and service of this motor should only be attempted by trained service technicians familiar with the Evergreen.

This motor should be installed in accordance with accepted practices and installation instructions, and in compliance with all national and local codes.

 **WARNING**

Always disconnect the main power from the unit being serviced before making any wiring connections to the Evergreen EM. It is also a good practice to confirm that the power is off with a meter.

 **WARNING**

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause personal injury, death, or property damage. Consult a qualified installer, service agency, or distributor for information and assistance. The qualified installer or agency must use the supplied or recommended parts when installing or servicing this product.

This installation/service manual enables a qualified technician to install, service, repair, and maintain the Evergreen EM motor. This manual should be kept near the HVAC system for future reference.



## Introduction and Features

The ultra-high-efficiency ECM has become the preferred motor for use in energy-saving HVAC systems. Evergreen EM is made with the same field-proven, high-efficiency ECM technology that has been used for more than 20 years in new HVAC equipment. The Evergreen EM was designed to replace direct-drive blower motors in residential and light commercial indoor furnaces, air handlers, and package systems that were designed with a standard ECM motor, such as an X13 or equivalent competitor model. It can also be used to retrofit PSC motors in commercial building series VAV boxes and packaged heat pump systems. It is NOT intended to replace premium ECM constant airflow products, such as Eon 2.3, 3.0, and 2.5.

### Features:

- Multi-speed, constant torque, brushless DC motor
- Available in 1/3, 1/2, 3/4 and 1HP ratings
- Available in either 115VAC or 208-230VAC single-phase input, 50/60Hz
- Maintains ECM-level Efficiency up to 80%
- Operating speed range of 600-1200 RPM
- Automatically determines motor direction using Genteq's Rotation Sensing Technology (See Rotation Sensing on page 11 for details)
- Soft Start and Off Ramp for quieter operation
- 5 Discrete Speeds using 24VAC (3 using 18VDC) signal inputs
- Variable Speed, Torque Control using a PWM Signal. (Motor switches to Variable Speed mode when a PWM input is detected)
- NEMA 48-frame (5.6 inch diameter) Belly Band Mount with 5-inch long, ½ inch diameter shaft.
- Class B insulation
- Electronic Thermal Overload Protection
- UL and CSA recognized component
- Shielded ball bearings
- Encapsulated Electronics



## Mounting

### ⚠ WARNING

Always disconnect the main power from the unit being serviced before disconnecting any wiring or removing any components. It is also a good practice to confirm that the power is off with a meter.

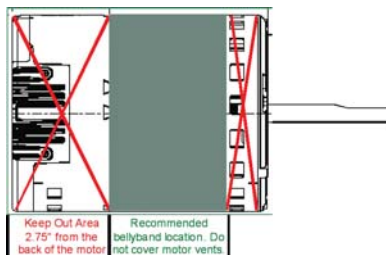
Remove the blower section from the HVAC system. Remove the existing ECM motor from the blower section and properly dispose of the motor.

The frame size of the Evergreen EM motor is NEMA 48 (5.6" Diameter). This is the most common frame size for indoor blower motors. The Evergreen EM requires a belly band style mounting bracket.

- If the existing motor mount is welded to the motor, bolted directly to the motor, or attaches to the bearing assembly of the motor, it cannot be used on the Evergreen EM. Genteq belly band kit 5K002 is recommended to replace the 4-lug mount shown below. See your local distributor or [theDealerToolbox.com](http://theDealerToolbox.com) for availability.



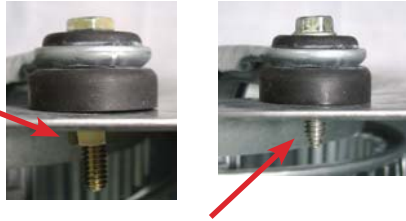
- Universal belly band motor mounts in multiple sizes are available from local distributors and [theDealerToolbox.com](http://theDealerToolbox.com)
- If the mounting bracket must be replaced, selecting one with the same mounting pattern on the blower housing will save drilling new holes in the blower section.
- The belly band must fit the new motor properly. It should be tight enough to prevent the motor from shifting on start-up and located according to the diagram below.



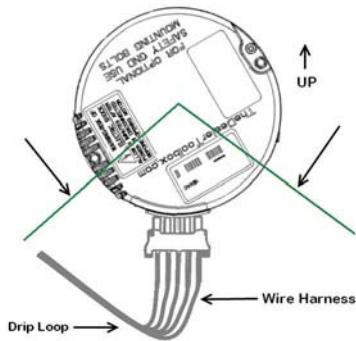


## Mounting (CONT'D)

If a new motor mount is required and the legs do not line up with the original holes in the blower housing, it is required to use a bolt with either a lock washer and nut or a locking nut through the drilled hole(s). Self tapping or sheet metal screws are not sufficient for a long term installation when a new hole is drilled through the thin wall of the blower housing.



When positioning the legs of the bellyband on the motor, make sure that once the motor is mounted into the blower section, the wires exit the bottom of the motor as installed in the air handler. This will insure that a proper drip loop can be made with the signal and power lines.



As installed in the air handler, the motor should be positioned with the connectors facing down between the 4 and 8 o'clock position, with the wiring harness formed into a drip loop.

The blower wheel should be centered in the blower housing. The wheel should also not be against the motor bearing housing. If this is not possible while centering the wheel, the motor should be adjusted in the belly band. If the blower wheel is dirty, it should be cleaned.



The blower wheel hub locking bolt should be secured to the flat portion of the motor shaft after the wheel has been centered in the blower housing.



Re-install the blower section in the HVAC system and proceed to the next page to make the electrical connections.



## Electrical Connections

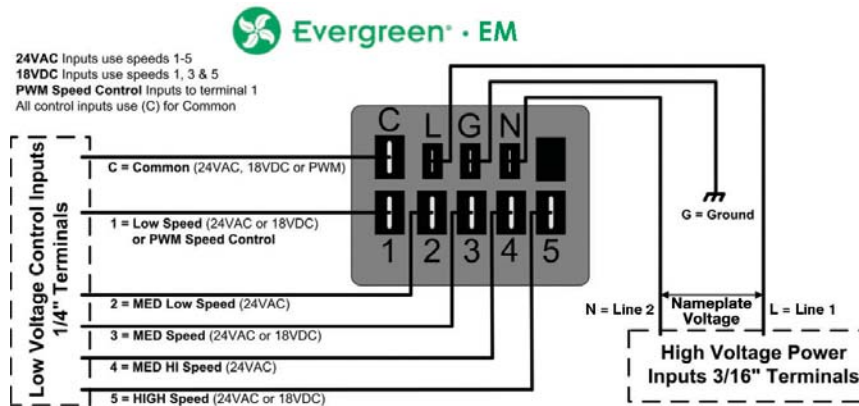
The unique design of the Evergreen EM allows for multiple speed operation using either 24VAC (18VDC) discrete inputs or variable speed, torque control using a PWM controller.

The high voltage power terminals, (L) and (N), must be connected to a continuous, un-switched power supply.

The motor on/off operation and speed/torque selections are connected using the low voltage (C) and (1-5) terminals.

- With 24VAC, the Evergreen EM provides 5 speed operation using terminals (C) and (1-5).
- With 18VDC, the Evergreen EM provides 3 speed operation using terminals (C), (1), (3), and (5)
- With the addition of a PWM controller, the Evergreen EM provides variable speed, torque control using terminals (C) and (1).

The Evergreen EM will automatically recognize the connected low voltage input and operate accordingly. Each motor provides all three low voltage control operations.



Detailed wiring for the High Voltage Power Connections and each unique Low Voltage Signal Connections are covered in the following sections.





# Electrical Connections

## High Voltage Power Connections

The Evergreen EM is designed for continuous un-switched connection to its rated high voltage power supply. Motor operation is controlled by low voltage signal inputs.

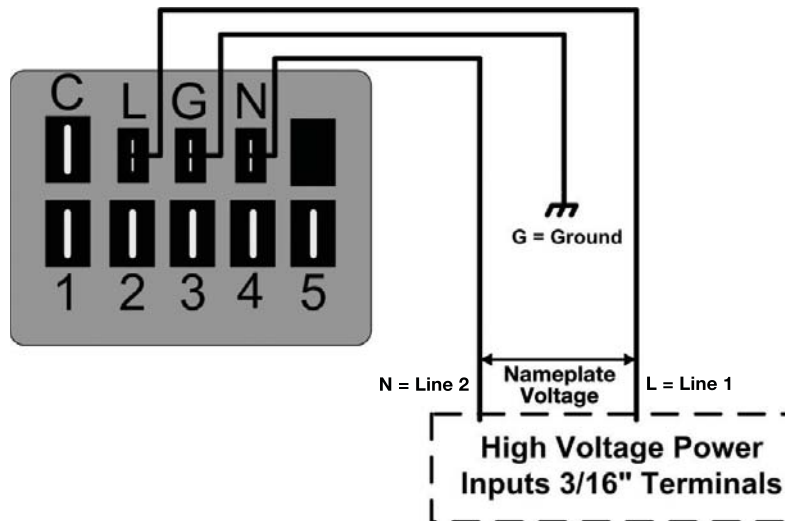
Always confirm the rating on the motor matches the power supply of the system it is applied to and/or the motor it is replacing.

If a door safety switch is present, wire after the switch so power will be disconnected when the door is removed for maintenance or service.

### WARNING

Always disconnect the main power from the unit being serviced before making any wiring connections to the Evergreen EM. It is also a good practice to confirm that the power is off with a meter.

1. Using 3/16" Female Quick Connect Terminals and 18 AWG wire, connect the (L) and (N) terminals on the motor to any un-switched line voltage L1 and L2, Nameplate Voltage power supply.
2. Using a 3/16" Female Quick Connect Terminal and 18 AWG wire, connect the (G) terminal on the motor to the system ground.





# Electrical Connections

## Low Voltage Signal Connections

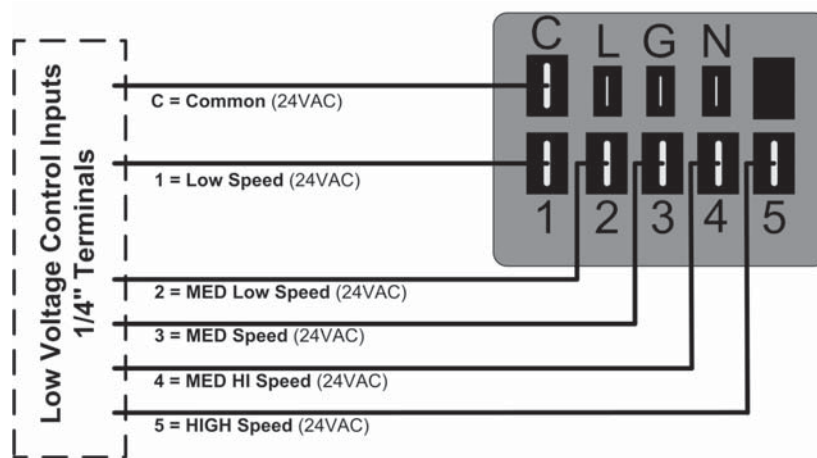
### - (24VAC) Discrete Speed Operation

The Evergreen EM has 5 available speeds using 24VAC control inputs. The inputs of the Evergreen can connect directly to the 24VAC thermostat terminal strip or 24VAC signal outputs from the HVAC system control board.

#### WARNING

DO NOT connect the Low Voltage SIGNAL (speed) terminals to the high voltage power supply. Applying voltage above 30VAC to these terminals will cause permanent damage to the motor.

1. Using a 1/4" Female Quick Connect Terminal and 22-18 AWG wire, connect the (C) Common terminal on the motor to the 24VAC common (C) thermostat terminal or 24VAC common side of the transformer on the HVAC System. Make sure that this line is not connected to the side of the transformer connected to the thermostat 24VAC (R). If it is connected to the (R) high side of the transformer, the motor will not operate.
2. Select operating speeds by using 1/4" Female Quick Connect Terminal(s) and 22-18 AWG wire to connect terminals (speeds) 1-5 to any 24VAC thermostat demand or 24VAC HVAC system control board output.





# Electrical Connections

## Low Voltage Signal Connections

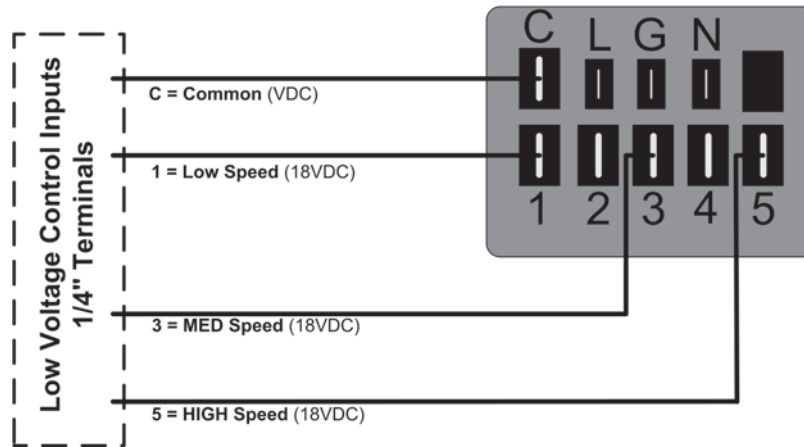
### - (18VDC) Discrete Speed Operation

The Evergreen EM has 3 available speeds using 18VDC control inputs.

#### WARNING

DO NOT connect the Low Voltage SIGNAL (speed) terminals to the high voltage power supply. Applying voltage above 23VDC to these terminals will cause permanent damage to the motor.

1. Using a 1/4" Female Quick Connect Terminal and 22-18 AWG wire, connect the (C) Common terminal on the motor to the DC common on the HVAC System control.
2. Select operating speeds by using 1/4" Female Quick Connect Terminal(s) and 22-18 AWG wire to connect terminals (speeds) 1, 3, or 5 to any 18VDC HVAC system control board output.





# Electrical Connections

## Low Voltage Signal Connections

### - Variable Speed Torque Control Option

The Evergreen EM can also be controlled in a variable speed, torque control mode using a PWM (Pulse Width Modulation) control on terminals (C) and (1). The motor will operate from 10% - 100% output depending on the input from the ECM PWM speed controller.

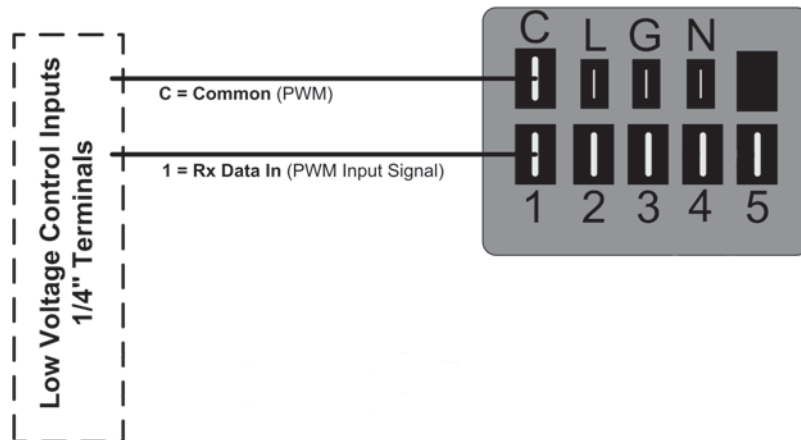
**A PWM control suitable for ECM motors must meet the following specifications:**

- 15-23 VDC at 67-93Hz or 127 to 199Hz
- 10% Guaranteed On and 5% Guaranteed Off Duty Cycle

### ! WARNING

DO NOT connect the Low Voltage SIGNAL (speed) terminals to the high voltage power supply. Applying voltage above 23VDC to these terminals will cause permanent damage to the motor.

1. Using a 1/4" Female Quick Connect Terminal and 22-18 AWG wire, connect the (C) Common terminal on the motor to the common on the PWM controller.
2. Using a 1/4" Female Quick Connect Terminal and 22-18 AWG wire, connect terminal (1) on the motor to the PWM signal on the PWM controller. Terminal (1) is setup for AUTOSWITCH. If a PWM signal is present, the motor will switch from discrete speed outputs to variable speed, torque control mode.





## Electrical Connections

### Final Notes

Retrofit ECM PWM controllers are available from manufacturers, some of which are listed on [www.theDealerToolbox.com](http://www.theDealerToolbox.com). Any control that meets the specifications listed on the previous page should operate the Evergreen EM properly. If there are questions regarding a particular add-on control or building automation system, please call Evergreen technical support at **866-503-8566**. Visit our website at [www.theDealerToolbox.com](http://www.theDealerToolbox.com) for support. Genteq is committed to helping with any special application questions that may arise.

Once all connections are made from the Evergreen EM to the HVAC system, ensure a proper drip loop is in place and verify it will not interfere with the blower wheel or other system wiring.

**Install the System ID Label on the HVAC system near the existing wiring diagram and enter the Evergreen EM data.** Record the Horse Power (HP) of the motor and the Date of Installation for future reference. The HP rating can be found on the label located on the box or the motor.

**Always verify the HVAC System operates in all applicable demand modes. For VAV systems, adjustments should be made to the speed taps or ECM PWM control input to balance the airflow per the OEM specifications.**



## Sequence of Operation

Nameplate-rated line voltage is connected to the High Voltage POWER terminals of the motor at all times. This voltage powers the micro-processor and the controls that drive the motor; however, the motor will only operate when there is a demand on the Low Voltage SIGNAL terminals.

**24VAC operation** – When using 24VAC, the motor will turn on and off at the speed selected with a 24VAC input. Multiple low voltage inputs can be sent to the motor at the same time (if needed) due to the hierarchy built into the control. Simply stated, multiple terminals can be energized at the same time. The motor will always operate at the highest speed tap (terminals 1-5) that is energized. There is no need to isolate one demand input from another. However, speed taps 1, 3, and 5 CANNOT be energized simultaneously, as this particular input configuration is used to reverse the rotation sensing decision.

**18VDC operation** – When using 18VDC, the motor will turn on and off at the speed selected with a 18VDC input. Multiple low voltage inputs can be sent to the motor at the same time (if needed) due to the hierarchy built into the control. Simply stated, multiple terminals can be energized at the same time. The motor will always operate at the highest speed tap (terminals 1, 3 or 5) that is energized. There is no need to isolate one demand input from another. However, speed taps 1, 3, and 5 CANNOT be energized simultaneously, as this particular input configuration is used to reverse the rotation sensing decision.

**Variable Speed Torque Control operation** – When using a PWM controller the motor will operate at the selected setting anytime there is a PWM signal present on terminals (1) and (C).

## Rotation Sensing

The first time the Evergreen EM is powered up and receives a signal on one of the Low Voltage Signal terminals, it will perform a Rotation Sensing process. With this feature, the motor will automatically determine the proper operating direction of the blower wheel by running the motor for several seconds in each direction.

**Do not turn off the “High Voltage Power” or the “Low Voltage Signal inputs” to the motor until the motor continues to run in one direction.** During Rotation Sensing, the motor will run in both directions, up to four times if necessary, to determine the proper operating direction. If the proper direction cannot be determined after the fourth sequence, the motor will operate in the default direction of counter clock-wise (CCW).

Once the motor continues to run in one direction, Rotation Sensing is complete and the feature is locked out. The motor will continue to start and run in this direction without performing Rotation Sensing even if the High Voltage Power is disconnected.

If the final operating direction of the motor is not the proper direction for the blower wheel, go to the “Troubleshooting Guidelines” on page 14; “Wrong Rotation”.



## Maintenance

The Evergreen EM motor is permanently lubricated and requires no maintenance.

Any signs of water damage on the replaced motor, in the HVAC system, or on the Evergreen EM should be taken very seriously. Fix the water issues immediately. If there are any signs of water damage to the Evergreen EM motor, it should be replaced to prevent serious injury to the occupants and the property.

All HVAC systems require annual maintenance to ensure maximum efficiency and capacity. Refer to the HVAC system manual for proper inspection and maintenance requirements. To keep the Evergreen EM motor and the air-side components clean, install and regularly maintain high-quality, properly sized filters.

## Reliability

The Evergreen EM is built with over 20 years of field experience in ECM indoor blower motors from Genteq, the leader in ECM technology. This 6th generation product includes the following reliability improvements:

- 4kV surge protection
- Speed limited for over current protection
- Encapsulated electronics to prevent moisture damage
- Ball bearings
- EMI filter



## Troubleshooting Guidelines

The **High Voltage Power** terminals (L) and (N) must be connected to nameplate rated voltage at all times. The acceptable High Voltage input range is 90-132VAC for 115V models and 180-264VAC for 208-230VAC models. If the motor does not operate, confirm this voltage is present at the motor and make repairs to the HVAC system if it is not. This voltage alone will not operate the motor. A low voltage input to terminals (C) and (1-5) is required for motor operation. **The (G) terminal on the motor should always be connected to earth ground for safety.**

**24VAC** will operate the motor at the respective speed when connected properly to terminals (C) and (1-5). When troubleshooting the motor, always check for voltage between terminals (1-5) and the (C) terminal at the motor.

- The (C) Common terminal on the motor must be connected to the 24VAC common (C) thermostat terminal or 24VAC common side of the transformer on the HVAC System. Make sure that this line is not connected to the side of the transformer connected to the thermostat 24VAC (R). If it is connected to the (R) high side of the transformer, the motor will not operate.
- If the motor does not operate or does not appear to operate at the desired speed, check the voltage between the applied terminal (1-5) and (C) at the motor. The acceptable voltage range is (12-30VAC). Correct any voltage issues. Do not assume the motor is failed unless you have confirmed proper high and low voltage inputs at the motor.

**18VDC** will operate the motor at the respective speed when connected properly to terminals (C) and (1, 3 or 5). When troubleshooting the motor, always check for voltage between terminals (1, 3 or 5) and the (C) terminal at the motor.

- The (C) Common terminal on the motor must be connected to DC common
- If the motor does not operate or does not appear to operate at the desired speed, check the voltage between the applied terminal (1, 3 or 5) and (C) at the motor. The acceptable voltage range is (15-23VDC). Correct any voltage issues. Do not assume the motor is failed unless you have confirmed proper high and low voltage inputs at the motor.  
**If 18VDC is applied to terminals (2) or (4), the motor will still operate.**  
**Applying 18VDC to terminal (2) will operate the motor at MED speed.**  
**Applying 18VDC to terminal (4) will operate the motor at HIGH speed.**



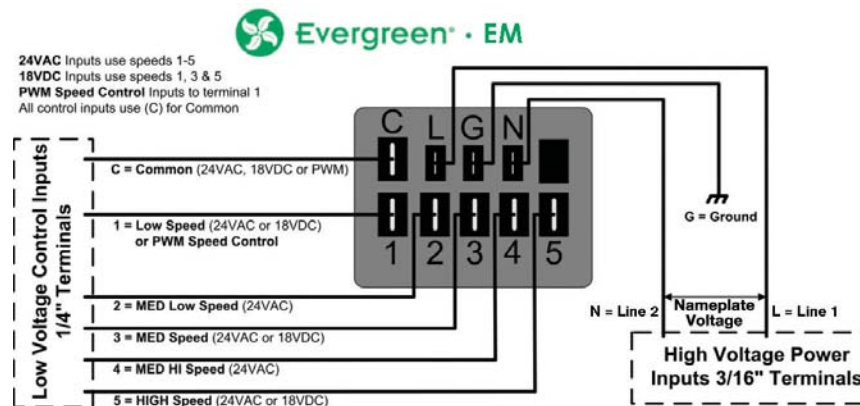


## Troubleshooting Guidelines (CONT'D)

**PWM** will operate the motor anytime a proper signal is present between terminals (C) and (1). The (C) Common terminal must be connected to the PWM controller. Check the PWM controller specifications for the appropriate DC signal. Check this signal at the motor on terminal (1). The specifications required by the motor are as follows:

- **15-23VDC at 67-93Hz or 127 to 199Hz**
- **10% Guaranteed On and 5% Guaranteed Off Duty Cycle**

Do not assume the motor is failed unless you have confirmed proper high voltage and PWM signal at the motor.



### Wrong Rotation

If the motor is not operating in the proper direction for the blower wheel, the rotation sensing decision will need to be altered. Following this procedure will allow the rotation direction to be changed several times.

#### **! WARNING**

ALWAYS DISCONNECT MAIN HVAC SYSTEM POWER BEFORE DISCONNECTING OR RE-CONNECTING ANY WIRES OR CONNECTORS TO THE EVERGREEN MOTOR.

1. Disconnect the main power to the HVAC system.
2. Disconnect the Low Voltage Control Input connections(s) from the motor.



## Troubleshooting Guidelines (CONT'D)

3. Connect motor terminals 1, 3, & 5 to either 24VAC or 18VDC and Common to terminal C.
4. Reconnect the main power to the HVAC system.
5. Energize motor terminals 1, 3, & 5 with either 24VAC or 18VDC and Common to terminal C continuously for a minimum of 5 minutes.
6. Disconnect the main power to the HVAC system for a minimum of 3 minutes.
7. Disconnect the 24VAC or 18VDC from motor terminals 1, 3, & 5 and Common from terminal C.
8. Reconnect the Low Voltage Control Input connection(s) to the motor.
9. Reconnect the main power to the HVAC system.

If the motor continues to operate in the wrong direction, repeat this procedure carefully and confirm all timings. If after several attempts, changing the rotation has not been successful, please call the **Evergreen Hotline at 866-503-8566**.

### Replacing the Evergreen EM

If the motor does not operate with proper High Voltage Power and low voltage communication present at the motor, it is failed and will require replacement. Before replacing the motor, please call the Contractor Hotline to confirm your diagnostics if possible. **The Evergreen EM is a single component replacement. The control cannot be replaced separately from the motor.** Contact the distributor where the motor was purchased or any authorized Evergreen distributor for replacement.

If the troubleshooting guidelines provided here do not solve the problem or you have a problem not listed here, please contact the **Evergreen Contractor Hotline 1-866-503-8566**. Additional support is available at **www.theDealerToolbox.com**.

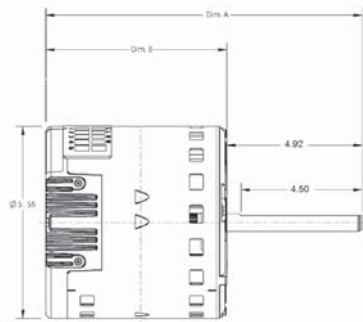


## Motor Specifications

Evergreen EM is an UL and CSA recognized component. The models listed here are all either 115VAC or 208-230VAC. The allowable voltage range is 90-132 VAC for 115VAC models and 180-264VAC for 208-230VAC models. Additional models may be available. See [theDealerToolbox.com](http://theDealerToolbox.com) for more details.

The frame size of all Evergreen EM motors is NEMA 48 (5.6" diameter). All shafts are 1/2" diameter, 4.92" long, with a single flat. See the listings below for each motors respective dimension from end shield to end shield (Dim. B) and end shield to shaft end (Dim. A).

	<u>Voltage</u>	<u>Stock #</u>	<u>Max Current</u>	<u>Dim. A</u>	<u>Dim. B</u>	<u>Approximate Weight</u>
<b>1/3 HP Models</b>	115V	6103E	4.8A	10.17"	5.25"	8.4 lbs.
	208-230V	6203E	2.8A			
<b>1/2 HP Models</b>	115V	6105E	6.8A	10.67"	5.75"	11.3 lbs.
	208-230V	6205E	4.1A			
<b>3/4 HP Models</b>	115V	6107E	8.4A	11.42"	6.5"	15.6 lbs.
	208-230V	6207E	6.0A			
<b>1 HP Models</b>	115V	6110E	10.9A	12.17"	7.25"	19.3 lbs.
	208-230V	6210E	7.6A			



### Ambient Temperature of all motors listed here.

- Storage: -40 to +85 degrees Celsius (-40 to 185 degrees Fahrenheit)
- Powered, not operating: -20 to +65 degrees Celsius (-4 to 149 degrees Fahrenheit)
- Operating (1/3 and 1/2 Hp): -20 to +55 degrees Celsius (-4 to 131 degrees Fahrenheit)
- Operating (3/4 and 1 Hp): -20 to +45 degrees Celsius (-4 to 113 degrees Fahrenheit)

# Need Additional Help?



**Evergreen**<sup>®</sup>  
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Contractor Hotline:  
1.866.503.8566

[thedealertools.com](http://thedealertools.com)



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