

EC MAX[®]

Electronically Commutated Motor
Wiring Manual

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Safety Considerations

The following definitions are used as safety considerations on EC Max and in this manual. Please read and observe all of these safety concerns.

Safety Symbols



Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.



Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Installation and service of this motor should be attempted only by trained service technicians familiar with EC Max instructions and training manual.

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

WARNING

EC Max is a multi-purpose replacement indoor blower motor. Proper wiring is critical to provide proper operation and maintain the proper operation of all safeties built into the HVAC system.

WARNING

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

WARNING

EC Max is a multi-volt capable motor. Read all instructions and install the proper jumper for the line voltage before applying power to this motor.

CAUTION

Use of the wires provided in this kit is recommended. Should additional wires be needed, use equivalent size wire gauge and rated insulation.

WARNING

Improper installation, adjustment, alternation, 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 your distributor or branch for information or assistance. The qualified installer or agency must use the supplied or recommended parts when installing or servicing this product.

Application Guide

EC Max can be used in the following applications

- Residential and light commercial HVAC split system (Air Handler and Fossil Fuel Furnace) units and Package Units;
- Indoor direct drive blower motors;
- Replace original equipment PSC (Permanent Split Capacitor) induction motors;
- Replace original equipment Constant Torque ECM (Electronically Commutated Motor) such as the genteq X13 and Endura Pro, or similar model motors with **24vac speed taps**.

EC Max is not compatible with the following applications

- HVAC systems that were originally supplied with Constant Airflow ECM also known as Variable Speed such as genteq models 2.0, 2.3, 2.5, 3.0 and Eon;
- Outdoor fan motors;
- Belt drive motors.

NOTE: In this manual, there are two sets of instructions. One for replacing PSC motors and one for replacing Constant Torque ECM. Please make sure to use the correct instructions for the motor you are replacing to prevent damage to the motor.

NOTE: The EC Max is mounted using a belly band mount. The mount is not provided. If the replaced motor used a belly band and was a NEMA 48 Frame motor, the original belly band can be used on the EC Max. However, it is not recommended to use a torsion flex mount on the $\frac{3}{4}$ and 1 Hp rated motors.

**For 46013 and 46012 use TFM55 for mounting.
For 46034 and 46001 use A60048 for mounting.**

The following items are supplied with this motor

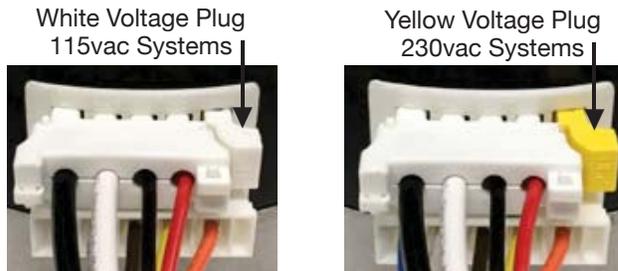
- Harness – the same harness is used for all applications;
- Voltage Plugs;
 - One for 115vac (white)
 - One for 230vac (yellow)
- Optional jumper wires and extra terminals;
- Optional Y-adapter;
- Installation manual.

NOTE
Use of included wiring harness is required for proper motor installation.



Using EC Max to replace PSC (Permanent Split Capacitor) induction motors.

- Install motor in HVAC system using a belly band mount.
- Select the voltage plug that matches the voltage rating of the replaced motor. Install the voltage plug. Connect the harness plugs to the motor.



• HIGH VOLTAGE POWER CONNECTIONS

- **Note: The Black and White HIGH VOLTAGE POWER wires are taped together and flagged for identification.**
- Connect the Black HIGH VOLTAGE POWER wire to a L1 line voltage power source that is continuously powered when the unit disconnect is closed
- Connect the White HIGH VOLTAGE POWER wire to a Neutral (115vac systems) or L2 (230vac systems) that is continuously powered when the unit disconnect is closed.

• HIGH VOLTAGE SIGNAL CONNECTION

- **Note: The Black and Red HIGH VOLTAGE SIGNAL wires are taped together and flagged for identification.**
- Connect the Black (HV1) HIGH VOLTAGE SIGNAL wire to all of the motor output terminals from the HVAC board (or fan relay) including Heat, Cool and Continuous Fan (if applicable) that were previously connected to the PSC motor. Use the supplied jumper wires and terminals or wire nut all together.
- Insulate the Red (HV2) HIGH VOLTAGE SIGNAL wire with a wire nut.

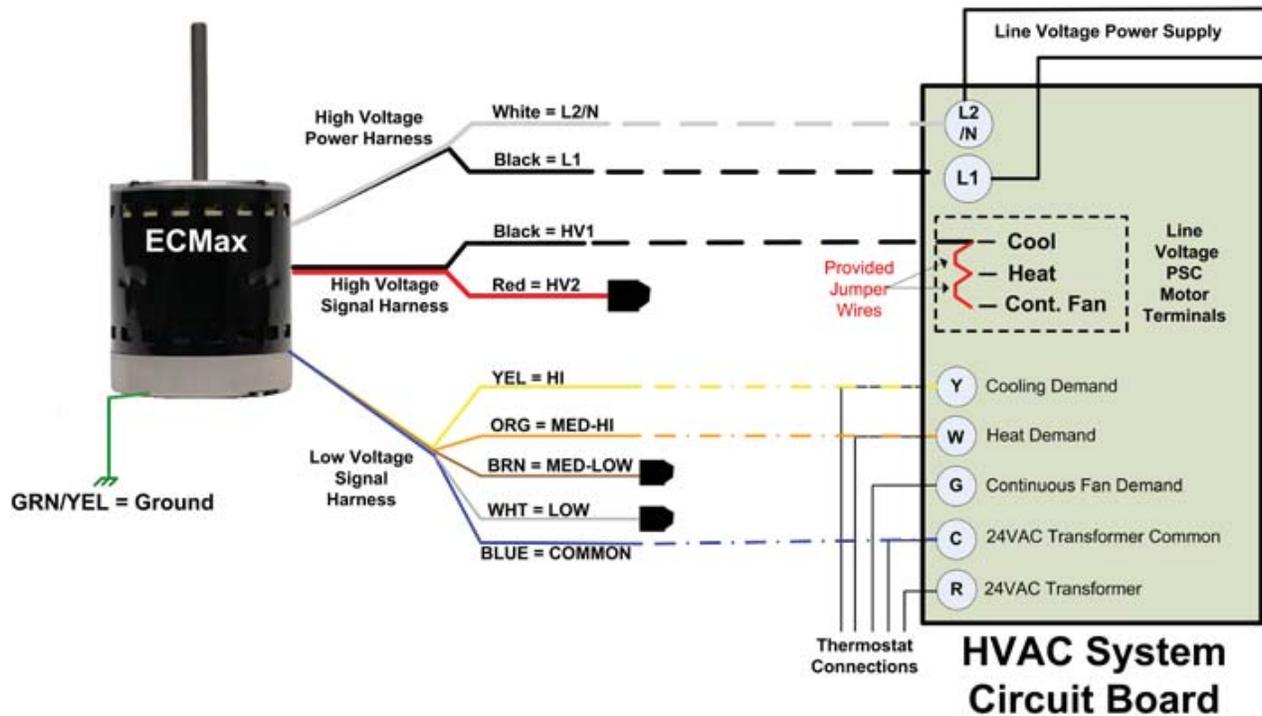
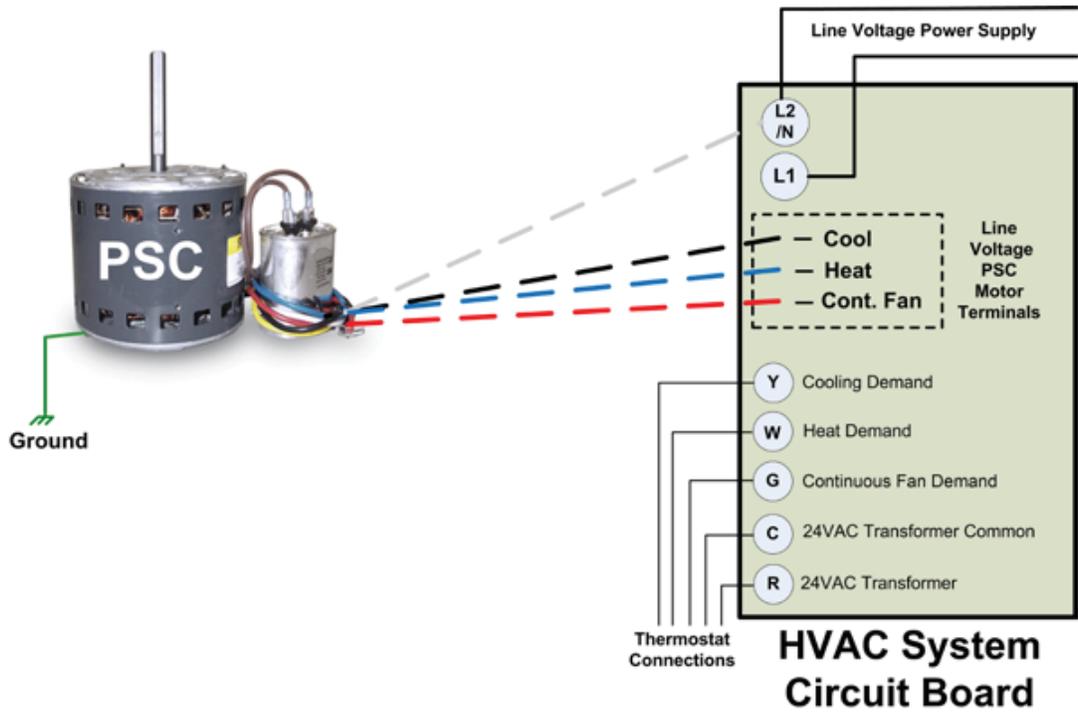
• LOW VOLTAGE SIGNAL CONNECTIONS

- **Note: All LOW VOLTAGE SIGNAL wires are taped together and flagged for identification.**
- Connect the Blue LOW VOLTAGE SIGNAL wire to the thermostat common terminal or directly to the common side of the 24vac transformer.
- Connect the speed desired for HEAT to thermostat (W) and the speed desired for COOL (including A/C or Heat Pump systems) to thermostat (Y).

• NOTE:

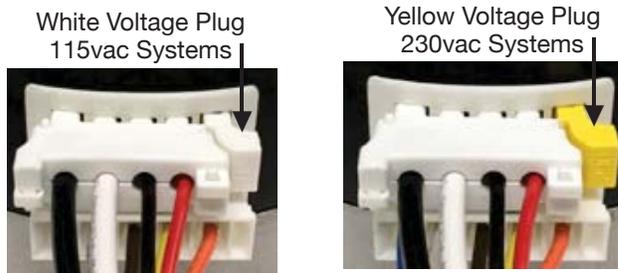
- **After completing all connections, the technician should operate the system in all demand modes measuring airflow using industry best practices. To adjust the airflow, change the speed selection connected to the appropriate thermostat terminal.**
- **If the system has a Continuous Fan selection at the thermostat, this demand will energize the motor through the fan relays to energize the Black (HV1) HIGH VOLTAGE SIGNAL input which will operate the motor at the default continuous fan speed. This speed is approximately 200 rpm slower than the LOW speed from the LOW VOLTAGE SIGNAL CONNECTIONS. If a higher continuous fan speed is desired, connect any unused speed selection to thermostat terminal (G).**

Using EC Max to replace PSC (Permanent Split Capacitor) induction motors.



Using EC Max to replace Constant Torque ECM with 24vac speed taps.

- Install motor in HVAC system using a belly band mount.
- Select the voltage plug that matches the voltage rating of the replaced motor. Install the voltage plug. Connect the harness plugs to the motor.



• HIGH VOLTAGE POWER CONNECTIONS

- **Note: The Black and White HIGH VOLTAGE POWER wires are taped together and flagged for identification.**
- Connect the Black HIGH VOLTAGE POWER wire to a L1 line voltage power source that is continuously powered when the unit disconnect is closed.
- Connect the White HIGH VOLTAGE POWER wire to a Neutral (115vac systems) or L2 (230vac systems) that is continuously powered when the unit disconnect is closed.
- **Note: These wires can be connected to the same terminals the Constant Torque ECM used for line voltage inputs.**

• HIGH VOLTAGE SIGNAL CONNECTION

- **Note: The Black and Red HIGH VOLTAGE SIGNAL wires are taped together and flagged for identification.**
- Connect the Red (HV2) HIGH VOLTAGE SIGNAL wire to a L1 line voltage power source that is continuously powered when the unit disconnect is closed. This wire can be connected to the same L1 source as the Black HIGH VOLTAGE POWER wire in the previous step.
- Insulate the Black (HV1) HIGH VOLTAGE SIGNAL wire with a wire nut.
- **Note: This wire can be connected to the same terminal as the L1 HIGH VOLTAGE POWER connection in the previous step.**

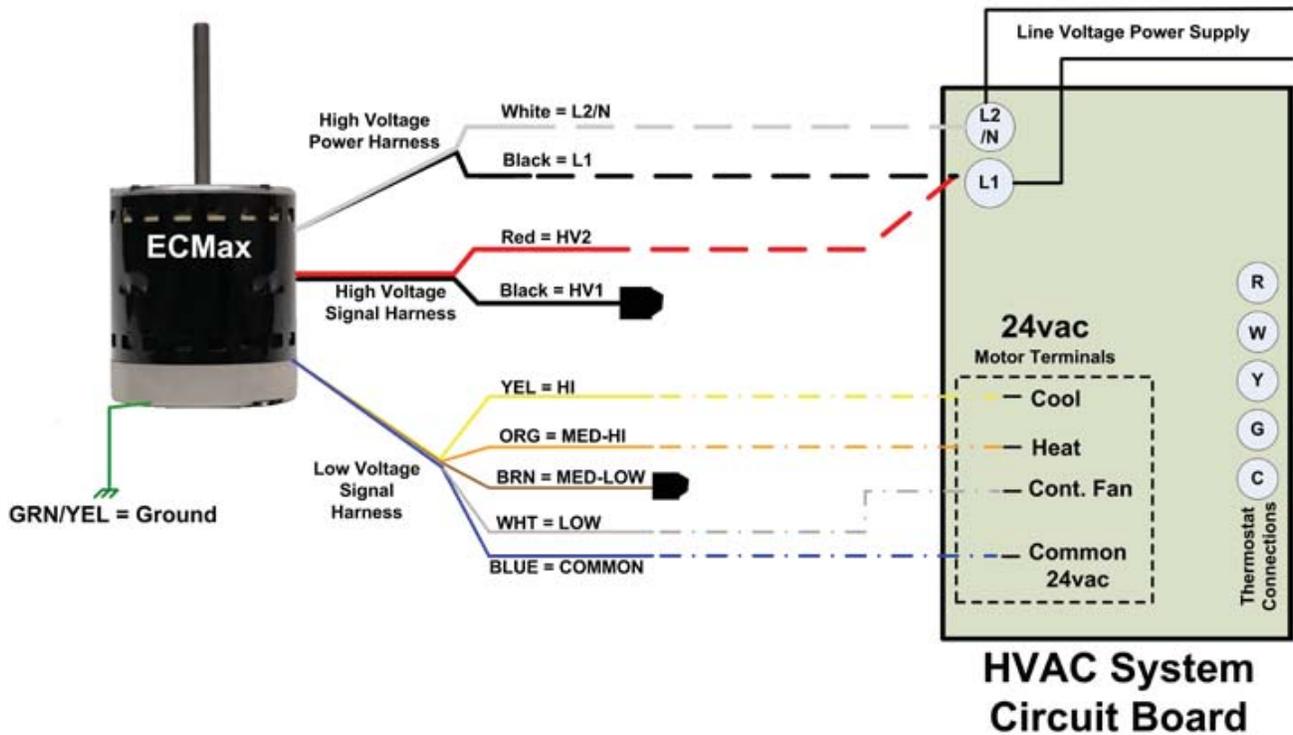
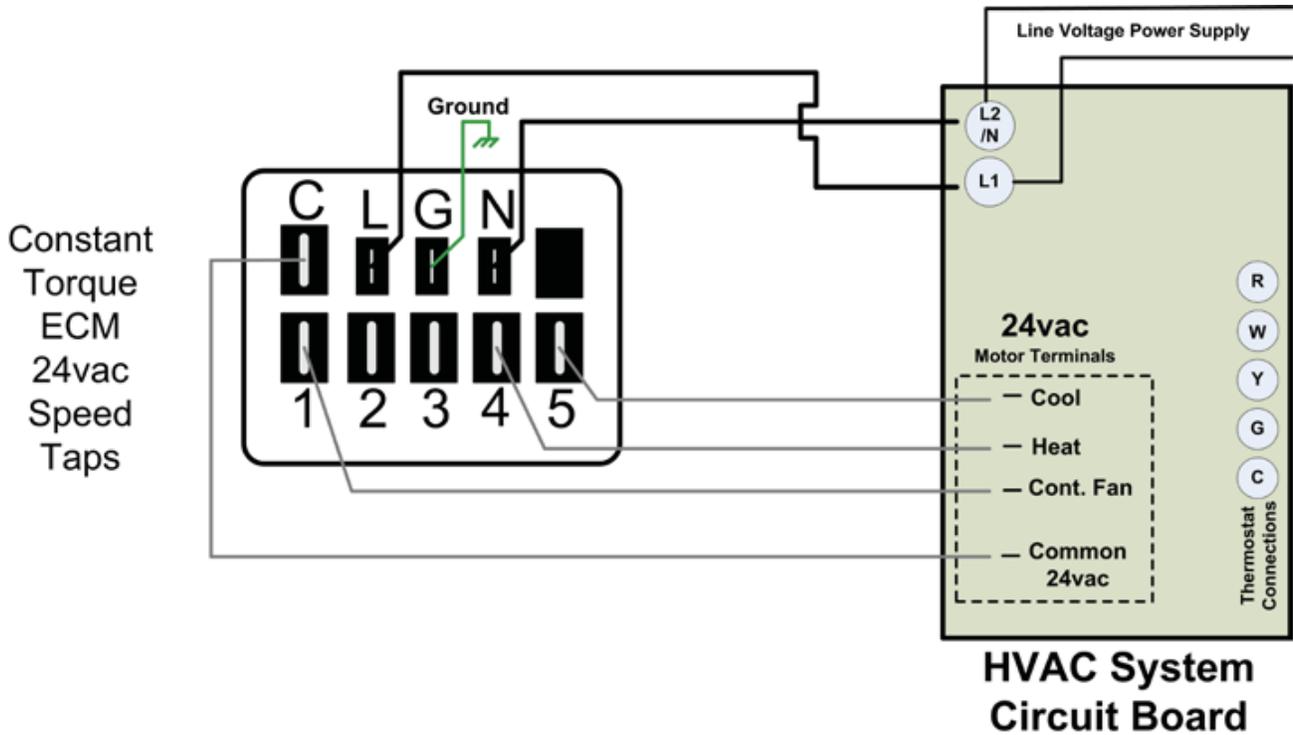
• LOW VOLTAGE SIGNAL CONNECTIONS

- **Note: All LOW VOLTAGE SIGNAL wires are taped together and flagged for identification.**
- Connect the Blue LOW VOLTAGE SIGNAL wire to the (C) terminal used by the motor that was removed or to the thermostat common terminal or to the common side of the 24vac transformer.
- Connect the speed desired for HEAT to the 24vac HEAT terminal and the speed desired for COOL (including A/C or Heat Pump systems) to the 24vac COOL Terminal used by the motor that was removed.
- If the system has a 24vac Continuous Fan terminal connect any unused speed to this terminal if desired.

• NOTE:

- **After completing all connections, the technician should operate the system in all demand modes measuring airflow using industry best practices. To adjust the airflow, change the speed selection connected to the appropriate demand terminal.**

Using EC Max to replace Constant Torque ECM.



Operational Characteristics

The Black and White HIGH VOLTAGE POWER wires provide the power to operate the electronics in the motor control and the power to operate the motor. These inputs are required to operate the motor but cannot turn the motor on by themselves.

The Black or Red HIGH VOLTAGE SIGNAL wires select the mode of operation.

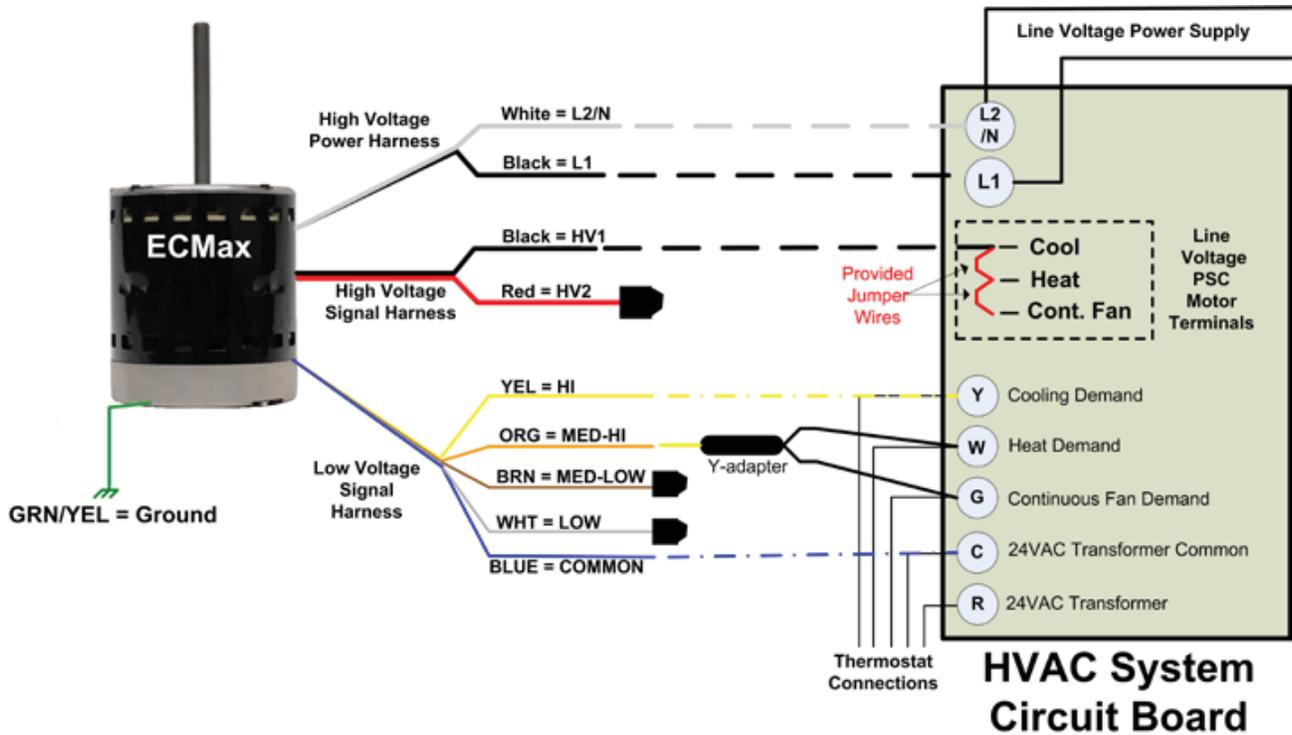
- When replacing **PSC motors** the Black wire (HV1) is energized from the fan relay(s). This creates the “ON” command for the motor. When the Black wire is de-energized from the fan relay(s) the motor will turn off. The level of output (speed) is determined by the LOW VOLTAGE SIGNAL wires. The Red wire (HV2) is not used in this configuration.
- When replacing **Constant Torque ECM** the Red wire (HV2) is energized with continuous line voltage power. This input is required to operate the motor but cannot turn the motor on by itself. When the Red wire is energized, the LOW VOLTAGE SIGNAL wires provide both the “ON/OFF” command for the motor and determine the output level (speed).

The LOW VOLTAGE SIGNAL wires provide the speed selection to the motor. These are 24vac inputs.

- The low voltage signal inputs are programmed with a hierarchy. If more than one input is energized at the same time, the higher tap value (speed value) will be operated. Multiple taps can be energized at the same time without damaging the motor.
- The optional Y-adapter is provided to allow multiple thermostat connections to the same speed without back feeding to each other. For example, if same speed is desired for multiple thermostat demands.
- **IMPORTANT NOTE: The Y-adapter will only work properly on the Low and Med-Hi speed taps.**
- NOTE: The Y- adapter is only needed when replacing PSC motors where the thermostat demands are used to energize the speed taps of the EC Max. When replacing Constant Torque ECM with 24vac speed taps, any speed can be connected to multiple fan relay outputs from the HVAC system control board or fan relay(s).

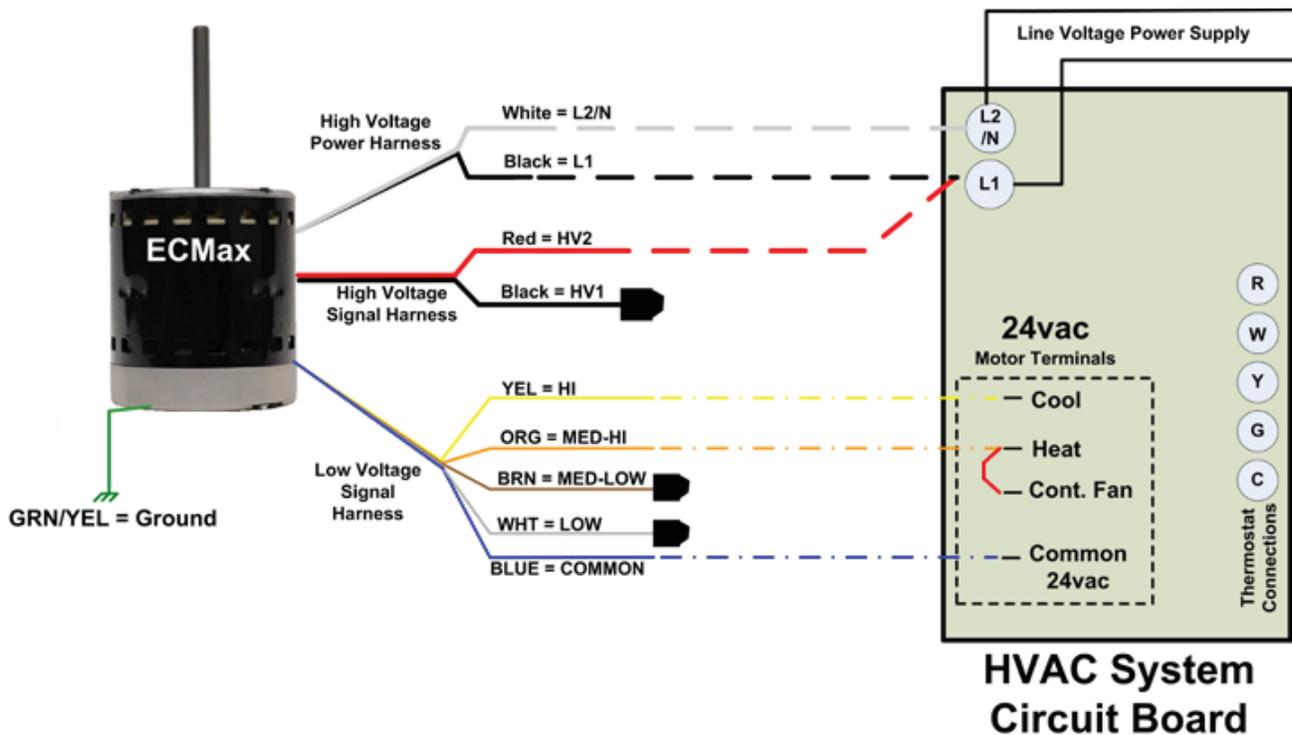
Using EC Max to replace PSC (Permanent Split Capacitor) induction motors.

- Example connection using the optional Y-adapter when replacing PSC motors.



Using EC Max to replace Constant Torque ECM.

- Example connection of one speed to multiple fan relay outputs from the HVAC system control board or fan relay(s).



Rotation is determined automatically the first time the motor is operated. It is important to operate the motor for the first time in the HVAC system. Do not bench test the motor. The first time the motor is operated the following sequence should be recognized:

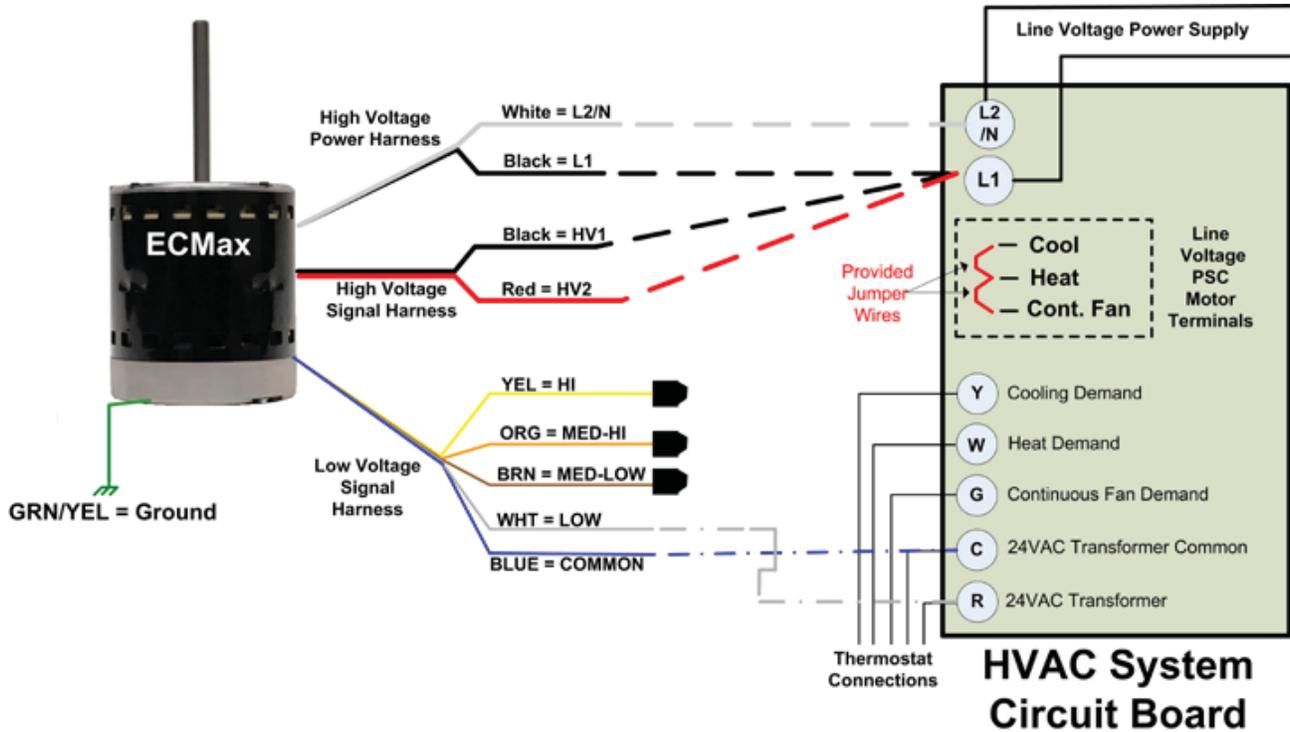
- The motor will run very slowly in CW rotation (lead end) for approximately 15 seconds then stop.
- The motor will run very slowly in CCW rotation (lead end) for approximately 15 seconds.
- The motor will then either:
 - increase speed (related to the speed selection energized) at the current CCW rotation if that is the direction it has selected;
 - or stop, reverse to CW rotation and increase speed to CW rotation.
 - Once the motor speeds up, the direction the motor is operating is the direction it has selected. It will now start and run in this direction the rest of its life. It will never perform this function again. If this is not the correct direction it can be reversed.

Changing the rotation of the motor after it has selected a rotation using the process above is accomplished with the following steps.

- Turn off the power to the HVAC system.
- Leave the HIGH VOLTAGE POWER wires connected
- Connect both the Black and Red (HV1 & HV2) HIGH VOLTAGE SIGNAL WIRES to the same L1 source as the Black HIGH VOLTAGE POWER wire.
- Leave the Blue LOW VOLTAGE SIGNAL wire connected to 24vac common.
- Disconnect all the LOW VOLTAGE SIGNAL speed wires from the motor to the HVAC system controls.
- Connect the White (Low Speed) LOW VOLTAGE SIGNAL wire only to the thermostat (R) terminal or directly to 24vac side of the transformer.
- Restore power to the HVAC system. There is no need for a thermostat demand. Set a stop watch for 1 minute.
- After 1 minute, turn off the power to the HVAC system and restore all wires to the desired configuration for the application.
- The next time the motor is energized it will operate in the opposite direction.

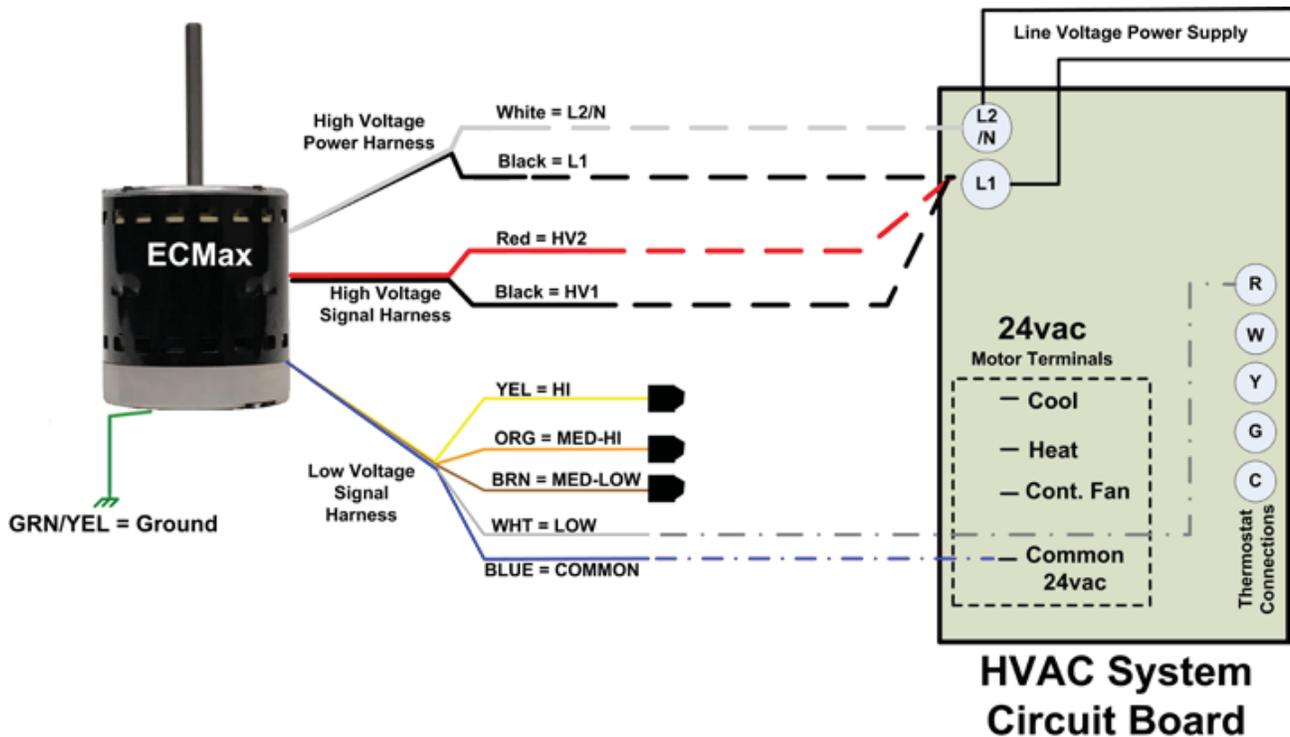
Wiring diagram for changing the rotation of the motor.

Using EC Max to replace PSC (Permanent Split Capacitor) induction motors.



Wiring diagram for changing the rotation of the motor.

Using EC Max to replace Constant Torque ECM.



Diagnosics, Maintenance & Warranty

Diagnosics

If the motor will not operate (turn on at any speed) see the information in the previous section related to Operational Characteristics and confirm the motor has the proper line voltage and 24vac inputs needed to operate.

To reverse the rotation of the motor, see the information in the previous section related to Operational Characteristics (pg 11).

Maintenance

The EC Max motor is permanently lubricated and requires no maintenance.

Warranty

- 1.All items sold by Packard, Inc. are warranted against defects in workmanship or materials under normal use for a period of one (1) year. Products are covered for up to a maximum of two (2) years from the manufacturer's date code on the product or one year after installation, whichever comes first.
- 2.No warranty is made as to the fitness of vendor's products for a purpose. Buyer acknowledges that it alone has determined that the goods purchased will suitably meet the requirements of their intended use. In no event will Packard be liable for consequential, incidental or other damages.
- 3.For products other than those listed below, please MAIL the original nameplate (label or sticker) for each item. Copies of labels will NOT be accepted. Please do NOT fax or email labels!
- 4.A reason for failure MUST be provided for each item on the warranty claim.
- 5.Credits are NOT to be taken by customer until merchandise or original nameplate has been received by Packard, Inc. and credit is issued.
- 6.Credit will be issued upon verification of purchase history for ORIGINAL labels dated within manufacturing date code requirements.
- 7.Do not field scrap products until credit has been issued.
- 8.In the event Packard or the manufacturer requires evaluation of warranty items, Packard will issue a return authorization form. Do not return warranty items unless requested.
- 9.Please contact Packard Warranty for these products prior to mailing claims.

Specifications

Voltage Ratings

- 115VAC (white voltage plug) allowable range 90-132VAC
- 230VAC (yellow voltage plug) allowable range 180-264VAC

Horsepower Ratings 1/3, 1/2, 3/4 & 1

FLA Ratings

- 1/3 Hp = 5.0/3.0
- 1/2 Hp = 6.7/4.0
- 3/4 Hp = 8.2/4.9
- 1 Hp = 11.0/6.7

RPM Rating 1075

Speeds (see chart below for estimated RPM values)

- 4 speeds (LOW, MED-LOW, MED-HI & HI)

Rotation CW or CCW (automatically configured)

Bearing Ball

Ambient Rating 40°C

Enclosure Open Air Over (OAO)

Frame size and dimensions NEMA 48 Frame (5.6" diameter) see diagram below for DIM A & B

- 1/3 Hp (DIM A = 11.26), (DIM B = 6.34)
- 1/2 Hp (DIM A = 11.26"), (DIM B = 6.34")
- 3/4 Hp (DIM A = 12.76", (DIM B = 7.84")
- 1 Hp (DIM A = 12.76"), (DIM B = 7.84")

Shaft .5" x 5" (4.5" single flat)

Mounting Belly band (not supplied)

Harness Lead length 48"

UL Recognized Component

4kV surge protection

SPEED (RPM) RATINGS.

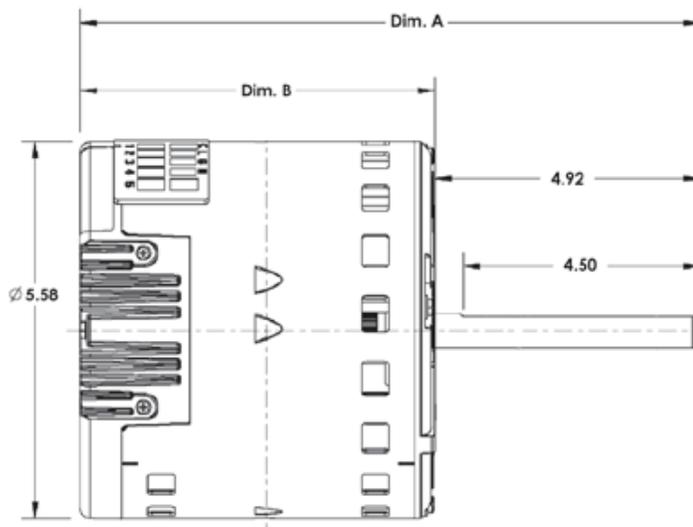
NOTE: ACTUAL RPM WILL VARY DEPENDING ON LOAD.

HI = 1075 RPM

MED-HI = 1000 RPM

MED LOW = 925 RPM

LOW = 850 RPM



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