ECM
Resistance Is Futile

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Training Manager

e·lab | education series | **HVAC** curriculum | genteq™

ECM Motors

- **ECM**
  - ECM Evolution and Industry Regulation
  - Overview ECM Technology
  - How to teach ECM

- Please sign attendance sheet
- NATE Recognized Provider Form
- Thumb Drive

NORTH AMERICAN TECHNICIAN EXCELLENCE
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HVAC ECM – Evolution and Industry Regulations

How well do you know your industry?

- Brand recognition due to acquisition.
- Evolution of ECM technology.
- Effects of industry regulation.

HVAC ECM – Evolution and Industry Regulations

What is the Genteq® Brand?

- Regal Beloit acquired General Electric's HVAC Motor business in 2004.
- Products offered by Regal Beloit after this acquisition (formerly offered by GE) were branded "GE ECM by Regal Beloit" for several years.
- In 2009, Regal Beloit announced the rebranding of this product line under the name, "Genteq"
- Regal Beloit Corporation is a US publicly traded company (NYSE) headquartered in Beloit, Wisconsin.

Global Operations

Beloit, Wisconsin

HVAC ECM – Evolution and Industry Regulations

What does the Genteq® brand represent?

- 30 years of ECM technology and innovation
  - **ECM technology was introduced in 1987**
- The leading brand in ECM technology in OEM applications and retrofit motors

HVAC ECM – Evolution and Industry Regulations

ECM Integration Overview

- 1987 CONSTANT AIRFLOW ECM introduced to HVAC
- 2006 SEER 13 Regulation
- 2019 Fan Energy Rating (FER) Regulation
  - Indoor blower & motor efficiency standard for furnaces
  - Electrical Efficiency Requirement (Regulates Watts/CFM)
  - Does not specify ECM to meet standard
  - Does not restrict the use of PSC
  - Lab testing suggests ECM will be needed to meet the standard
  - Effective Date July 1, 2019

ECM Integration Overview

- OEM HVAC Indoor Blower Motors in **1986**
  - Furnace, Air Handler and Package Unit applications
    - 100% PSC Motors
      - Direct drive

HVAC ECM – Evolution and Industry Regulations

ECM Integration Overview

- OEM HVAC Indoor Blower Motors in **2005**
  - **Furnace, Air Handler and Package Unit applications**
    - 85% PSC Motors

    - 15% Constant Airflow (Variable Speed) ECM Motors

Industry shift due to technology evolution (Constant Airflow ECM introduced in 1987)

1987-1992

1992-1998

1998-2013

HVAC ECM – Evolution and Industry Regulations

ECM Integration Overview

- OEM HVAC Indoor Blower Motors in **2006**

Industry shift due to SEER 13 Regulation (Constant Torque ECM introduced same year)

  - 45% PSC Motors
    - **Furnace**

  - 40% Constant Torque ECM Motors
    - Air Handler and Package Unit

  - 15% Constant Airflow (Variable Speed) ECM Motors
    - **Furnace, Air Handler and Package Unit**

HVAC ECM – Evolution and Industry Regulations

ECM Integration Overview

- OEM HVAC Indoor Blower Motors in **2018**
  - 45% PSC Motors
    - **Furnace**

  - 40% Constant Torque ECM Motors
    - **Air Handler and Package Unit**

  - 15% Constant Airflow (Variable Speed) ECM Motors
    - **Furnace, Air Handler and Package Unit**

ECM Evolution (Next generation 16-pin and new 4-pin Constant Airflow motors)

2013

2007

HVAC ECM – Evolution and Industry Regulations

ECM Integration Overview

- OEM HVAC Indoor Blower Motors in **2019**
  - 45% Constant Torque ECM Motors
    - **Furnace**
  - 40% Constant Torque ECM Motors
    - **Air Handler and Package Unit**
  - 15% Constant Airflow (Variable Speed) ECM Motors
    - **Furnace, Air Handler and Package Unit**

Expected industry shift due to FER Regulation

ensite™

New design from Genteq® Separate line and 24vac input plugs

HVAC ECM – Eduction

HVAC ECM Educational Needs

- ECM applications and operation
- ECM diagnostics
- ECM replacement

Resources –
- HVAC OEM literature
- Industry text books

- Retrofit ECM
  - Motor manufacturer's literature

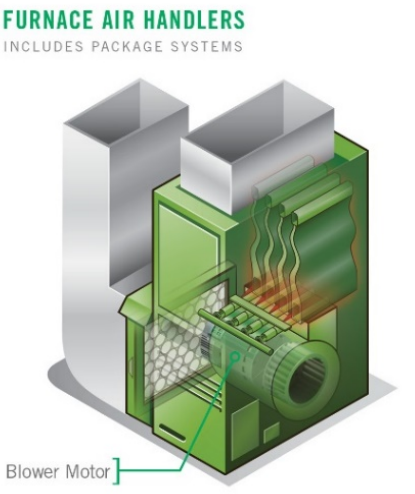
Constant Airflow ECM

e·lab education efficiency experience

Constant Airflow ECM

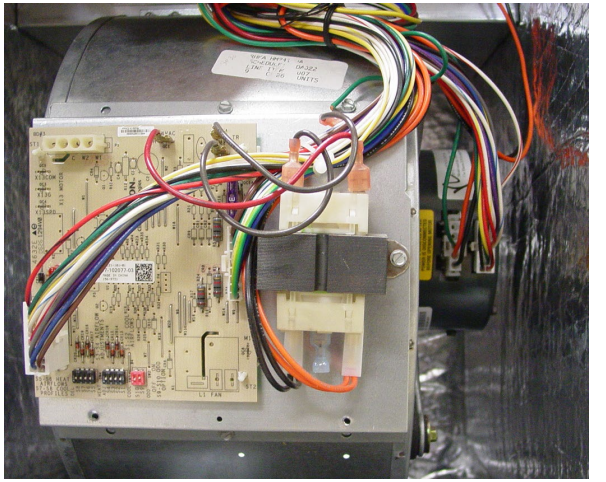
- Applications
  - HVAC Indoor Blower
  - Premium Systems

- Communicated
  - Output adjusted at OEM controls using OEM literature
  - Airflow values programmed by OEM unique to each HVAC system.



Communicated ECM

- Unique communication between OEM control board and ECM control
- Determines airflow and comfort settings



16-pin Communication Input Plug

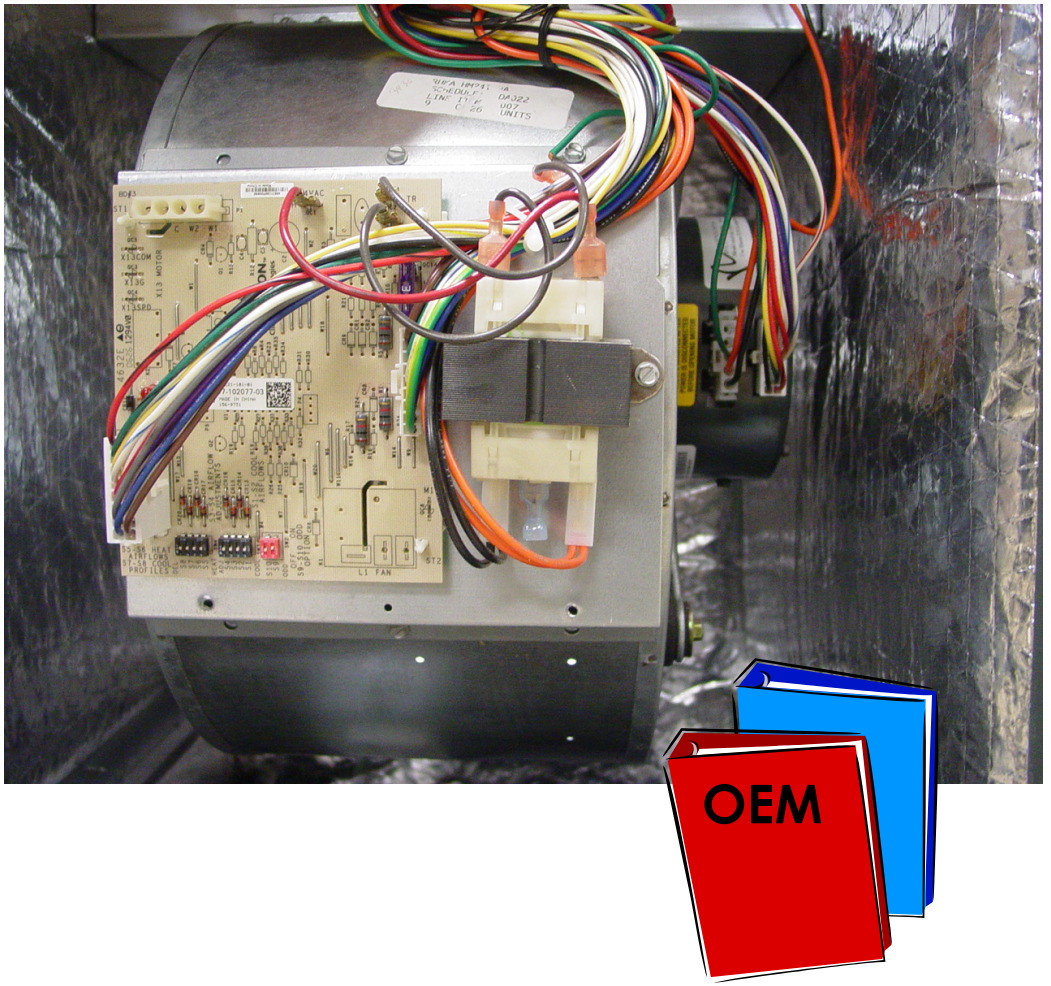
5-pin Line Voltage Input Plug

4-pin Communication Input Plug

Constant Airflow / OEM HVAC / Indoor Blower

Installation Set-up

- Cooling Airflow
- Heating Airflow
- Trim/Adjust Multipliers
- Climate (delay) Profiles
- Humidistat Option
- Continuous Fan



Operational issues and component failure can be directly related to improper system configuration.

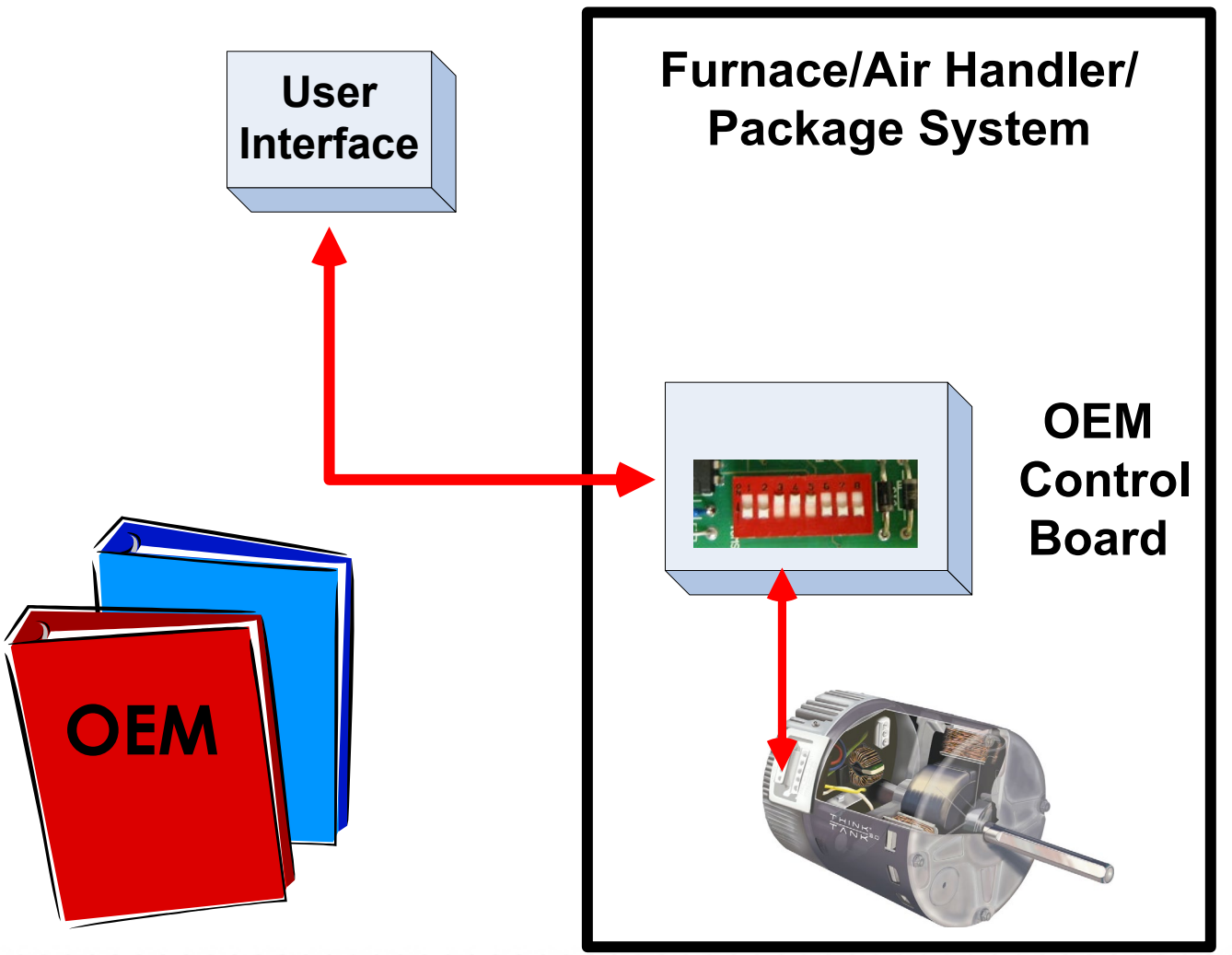
Constant Airflow / OEM HVAC / Indoor Blower

	Cooling Airflow Selection								
	2nd Stage	Dip Switch Number							
	CFM	1	2	3	4	5	6	7	8
A	800	0	0						
B	1000	1	0						
C	1200	0	1						
D	1400	1	1						

	Heating Airflow Selection									
	Temp Rise Range (30 - 60°F)									
	2nd Stage	Dip Switch Number								
	CFM	1	2	3	4	5	6	7	8	Rise (°F)
A	550			0	0					51
B	600			1	0					47
C	650			0	1					43
D	700			1	1					40

	Tirm/Adjust Airflow Selection								
		Dip Switch Number							
	CFM	1	2	3	4	5	6	7	8
A	Norm					0	0		
B	+10%					1	0		
C	-10%					0	1		
D	N/A					1	1		

Climate/Delay Profile Selection								
	Dip Switch Number							
	1	2	3	4	5	6	7	8
A							0	0
B							1	0
C							0	1
D							1	1



Airflow (Why TESP is so important)

- Airflow remains constant within OEM guidelines
  - Typical guidelines (0.1 – 1.0 TESP)
  - OEM airflow characterization
- Above maximum TESP airflow will decrease
- Higher TESP = Higher energy consumption
- Continuous high TESP = Decreased Motor life

Constant Airflow / OEM HVAC / Indoor Blower

PSC vs. Constant Airflow

Hz	Voltage	HP	PF	Motor Type
60	115	1/2	0.9	PSC (Induction Motor)
High	Speed			

TESP	0.3	0.5	0.7	0.9
CFM	1345	1261	1158	1038
Watts	700	667	628	576
Amps	6.69	6.47	6.1	5.71

Hz	Voltage	HP	PF	Motor Type
60	115	1/2	0.6	ECM (Constant Airflow)
3 Ton				

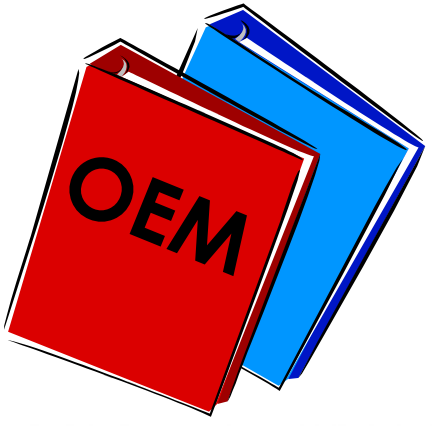
TESP	0.3	0.5	0.7	0.9
CFM	1246	1250	1234	1230
Watts	308	368	423	485
Amps	4.81	5.64	6.39	7.22

Data is from lab testing on one particular unit. Numbers may vary from one unit to another.

ECM Motors are not the cure for bad ductwork!

ECM Motors are not the cure for negligence!

Servicing Constant Airflow (Variable Speed - Communicated) Indoor Blower ECM



Diagnostics

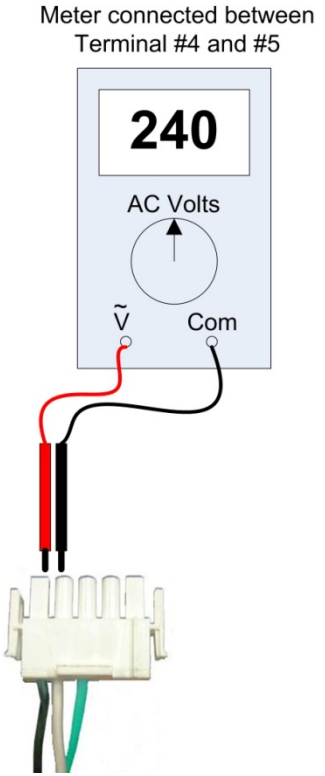
- Control Diagnostics
  - Line Voltage
  - Communication
- Motor Diagnostics
  - Ohms

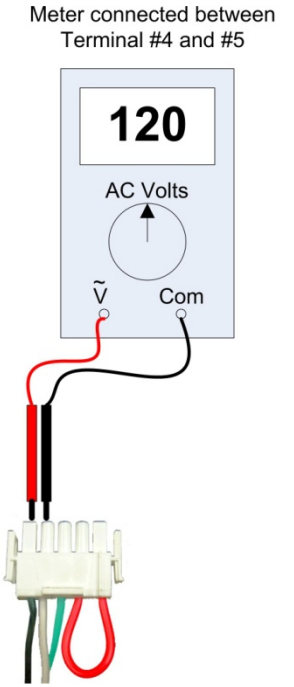
All Genteq OEM ECM Indoor Blower Motor diagnostics are covered in the ECM Service Guide.

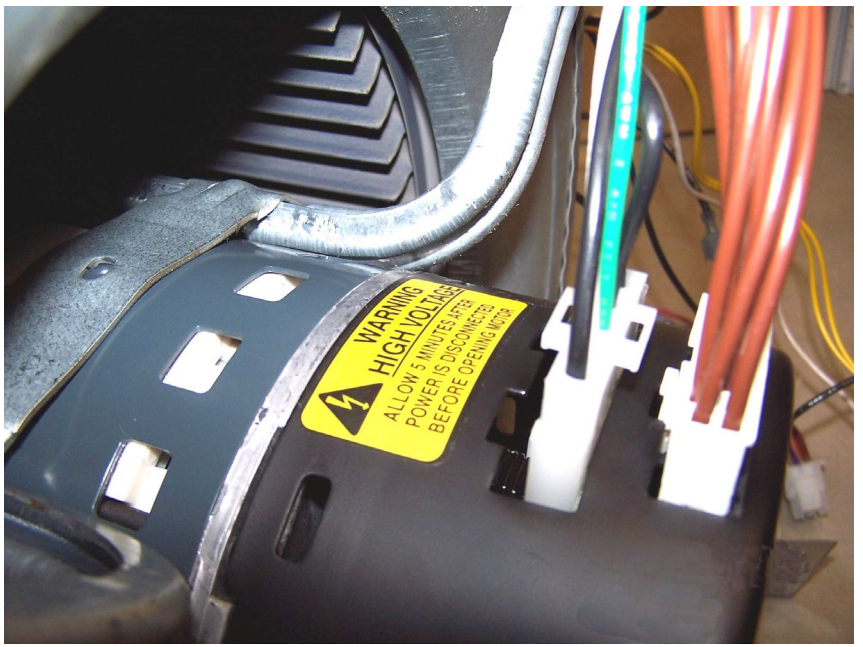
- Free download or order hard copy **TheDealerToolbBOX.com**
- Included in free app **TheDealerToolBELT**

Constant Airflow / OEM HVAC / Indoor Blower

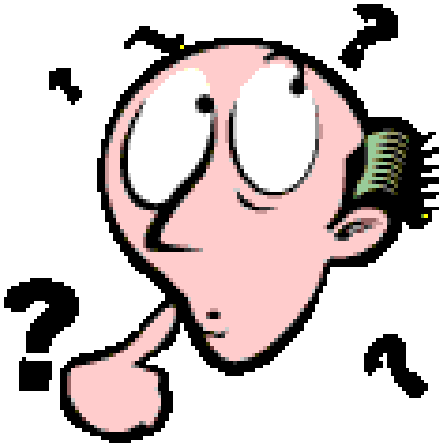
- **Line Voltage Input**

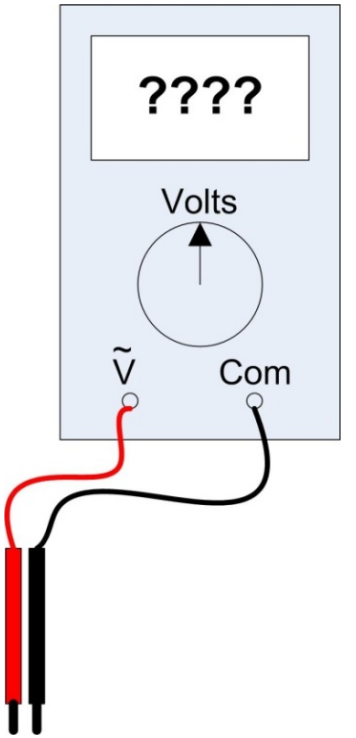


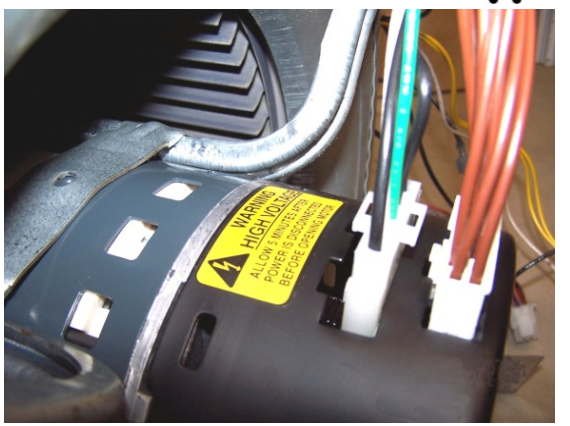




- **Communication Input**
  - Communication inputs can be diagnosed with OEM literature.
  - Required OEM literature must be obtained directed from each OEM for each individual unit.

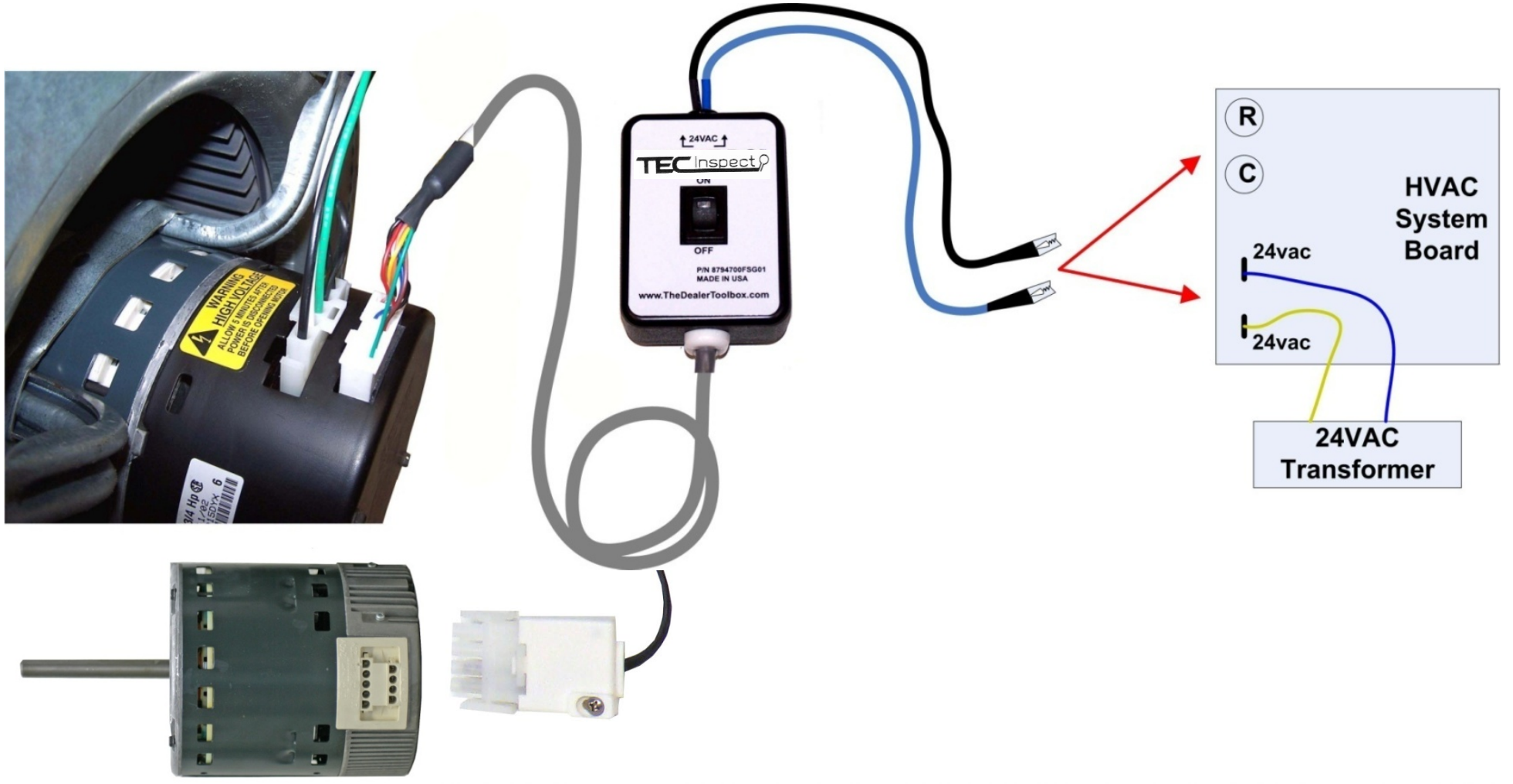






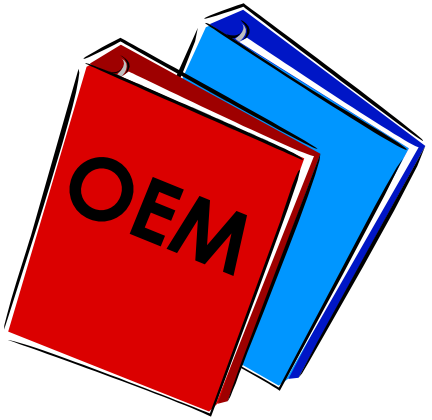
Constant Airflow / OEM HVAC / Indoor Blower

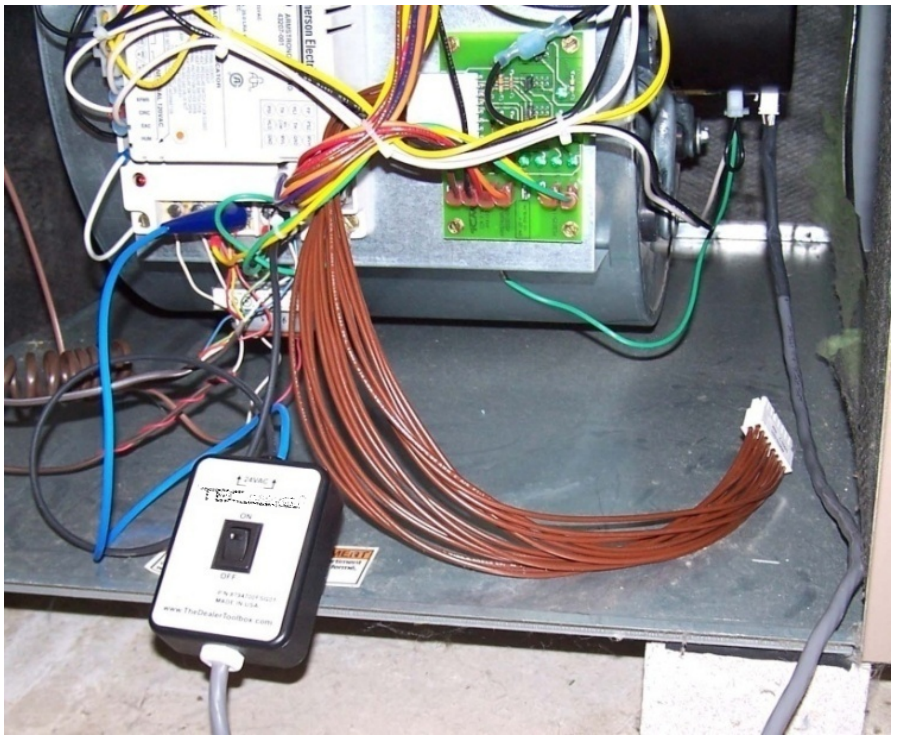
- **Run test with TECINspect – Genteq Motors**



Diagnostics – Genteq Motors

- If ECM operates with TECINspect
  - Diagnose OEM board with OEM manual





Diagnostics – Genteq Motors

- If ECM does not operate with TECINspect
  - Replace entire ECM (motor and control) if

    - OEM specified
    - Motor fails Ohm tests (ECM Service Guide)
    - Does not rotate freely by hand
  - Replace ECM control only if:

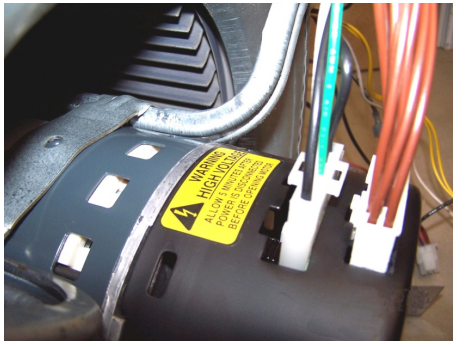
    - Available from OEM
    - Motor passes Ohm tests (ECM Service Guide)
    - Rotates freely by hand

Motor Diagnostics

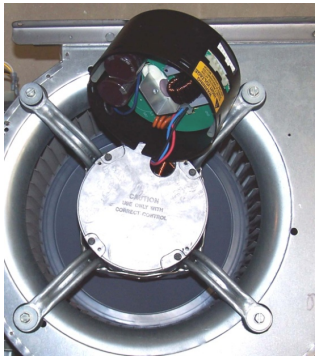
- **Warning: Disconnect AC power from the HVAC system and wait 5 minutes before opening motor to avoid electrical shock from the motors capacitors.**

Motor Diagnostics

Step 1 – Unplug the 16-pin connector and the 5-pin connector from the motor control.

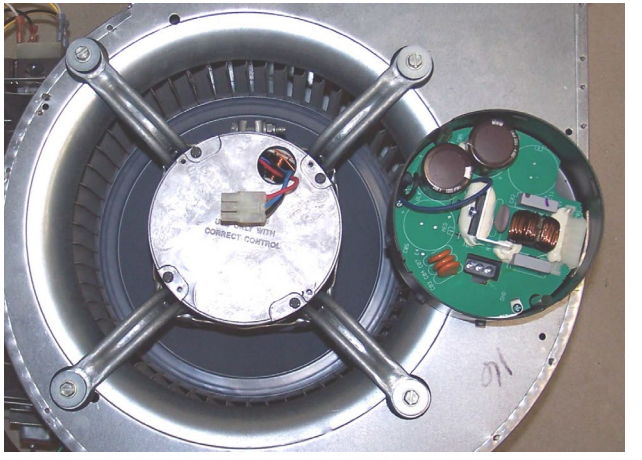


Step 2 – Remove the blower assembly from the HVAC system.



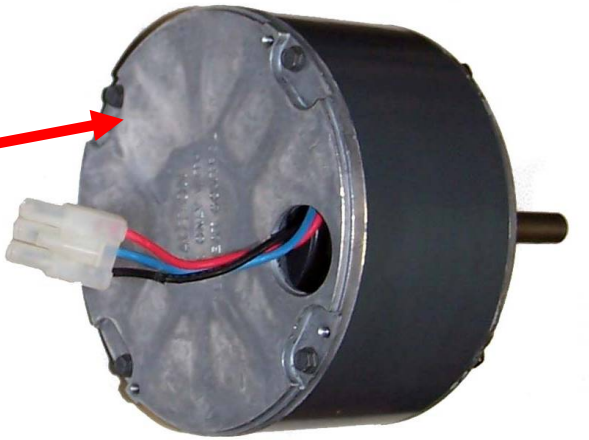
Step 3 – Remove the two (2) hex-head screws from the back of the control.

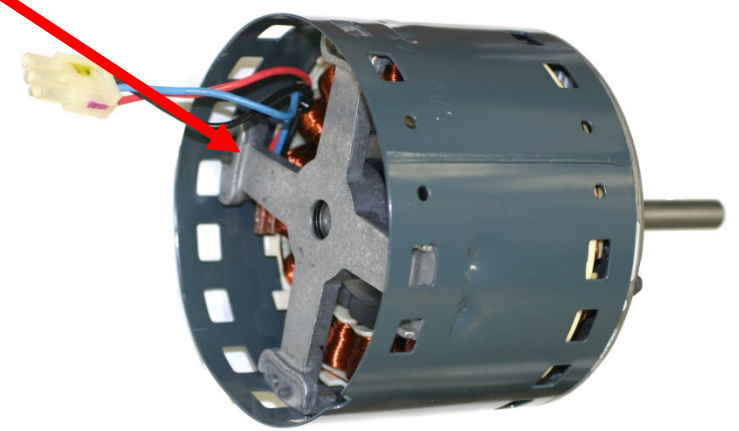
Step 4 - Unplug the 3-pin connector from inside the control by squeezing the latch and gently pulling on the connector.



Motor Module Tests

Test A – measure the resistance between each of the 3 motor leads to the unpainted part of the end shield (models 2.0, 2.3 & 2.5) or the X brace (models Eon & 3.0).

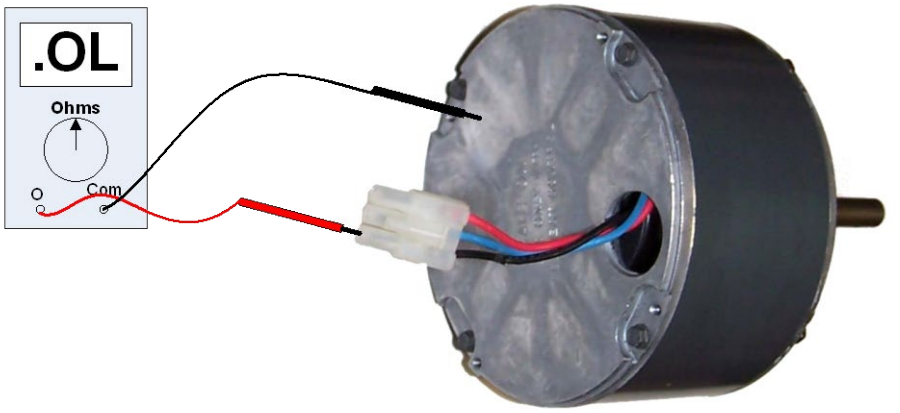




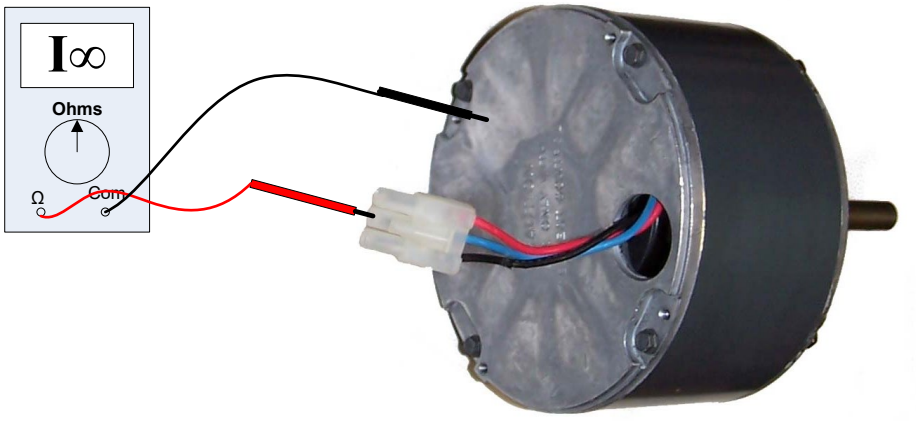
Constant Airflow / OEM HVAC / Indoor Blower

Motor Module Test A (Winding to Ground Resistance)

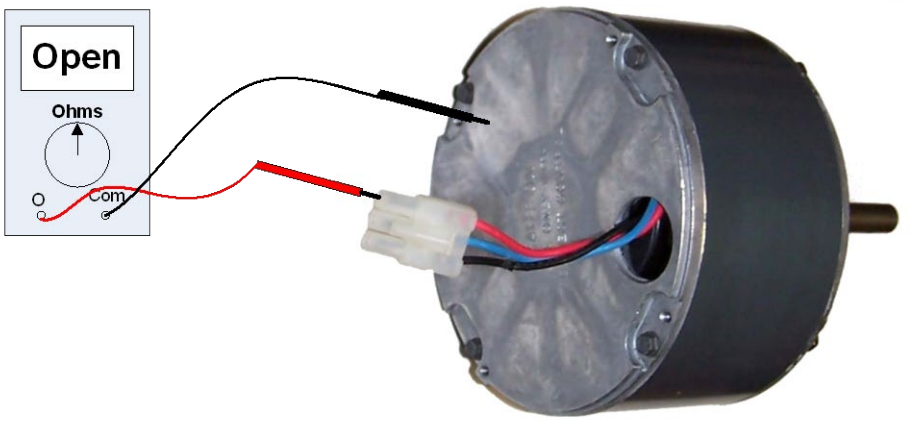
Lead 1 to Ground
Pass



Lead 2 to Ground
Pass



Lead 3 to Ground
Pass



1. **The resistance from each winding lead to ground must be > than 100K ohms.**

Motor Module Tests

Test B – measure the motor phase-to-phase resistance by checking these combinations of the 3-pin motor connector with an ohmmeter. For the purpose of this test, start at either end of the connector as Lead 1.

1. **The lead to lead resistance across any two leads should be less than 20 ohms.**

2. **Each lead to lead resistance should be the same within ± 10%.**

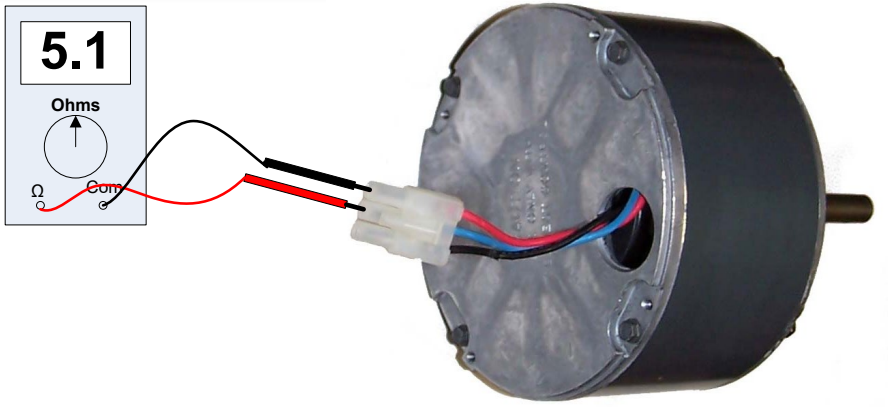
- Lead 1 to Lead 2
- Lead 1 to Lead 3
- Lead 2 to Lead 3

Constant Airflow / OEM HVAC / Indoor Blower

Motor Module Test B (Phase to Phase Resistance)

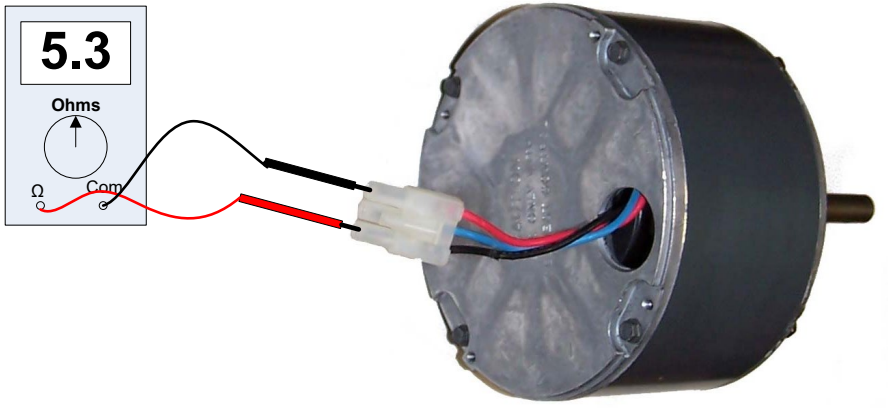
Lead 1 to Lead 2

Pass



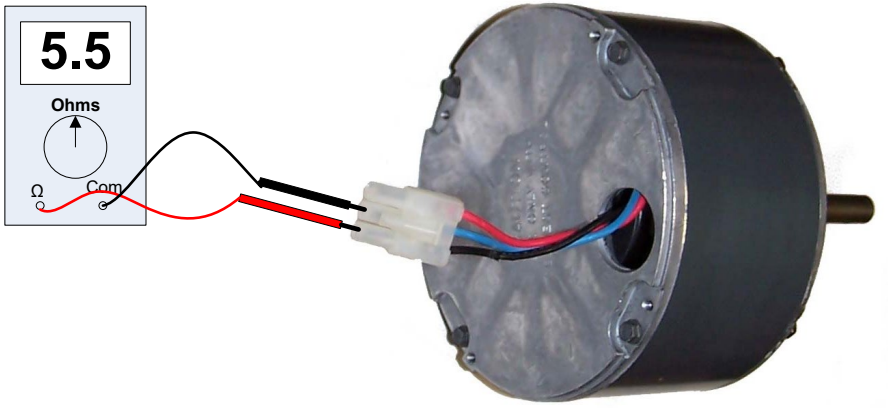
Lead 1 to Lead 3

Pass



Lead 2 to Lead 3

Pass



1. **The lead to lead resistance across any two leads should be less than 20 ohms.**

2. **Each lead to lead resistance should be the same within ± 10%.**

Constant Airflow / OEM HVAC / Indoor Blower

- **If the motor module fails either test or is difficult to rotate by hand:**
  - Replace both the motor control and the motor

- **If the motor module passes both tests and is easy to rotate by hand:**
  - Replace the motor control only

Constant Airflow ECM Wrap-Up

- Two tools
  - Volt/Ohm Meter
  - Genteq TECINspect
    - Test the ECM Motor
- Four checks
- Accurate
- Saves Time
- Saves Parts Change-out
- Easily diagnose motor control and motor

Compatibility

- TECINspect
  - Genteq Models 2.0, 2.3, Eon, 3.0
  - Genteq Tool

2.0

2.3

Eon

3.0

KGBSD0301FMS

Genteq Model 2.5

- ECM Motor Simulator
  - **Not compatible w/TECINspect**
  - Early model Infinity/Evolution
  - **Carrier/Bryant Tool**

2.5

CARRIER	BRYANT	PAYNE
90% Furnace Models		
59MN7A	987MA	PG9UAA
59TN6A	355CAV	– –
58MVC	355BAV	– –
58UVB	355AAV	– –
58MVB	355MAV	– –
58MVP	321AAZ*	– –
58VUA*	320AAZ*	– –
58VCA*	398BAZ*	– –
58SXB*	398BAW*	– –
80% Furnace Models		
58CVA	315A	PG8MVA
58CVX	315J	PG8JVA

Constant Airflow / OEM HVAC / Indoor Blower

Repair

- **Programs are specific to HVAC OEM, model and size unit**
  - **Replacement parts with the correct OEM program must come from HVAC OEM**
    - **NOT FIELD REPAIRABLE**
  - Using the wrong motor voids all warranties
    - May produce unexpected results
  - Follow all instructions with replacement parts
  - Current generation products are backward compatible
  - **Generic retrofit options are in the near future**

Repair

- Prevent repeat failures
  - Most fatal damage caused by:
    - Water damage
    - Voltage Spikes
      - Add surge protection to homes in high risk areas
    - Operation at high Total External Static Pressure
      - Measure and correct if needed

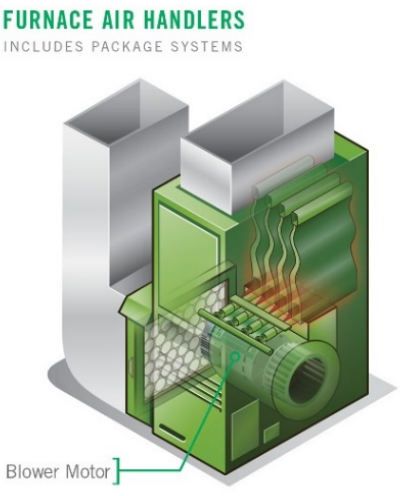
Constant Torque ECM

e·lab education efficiency experience

Constant Torque ECM

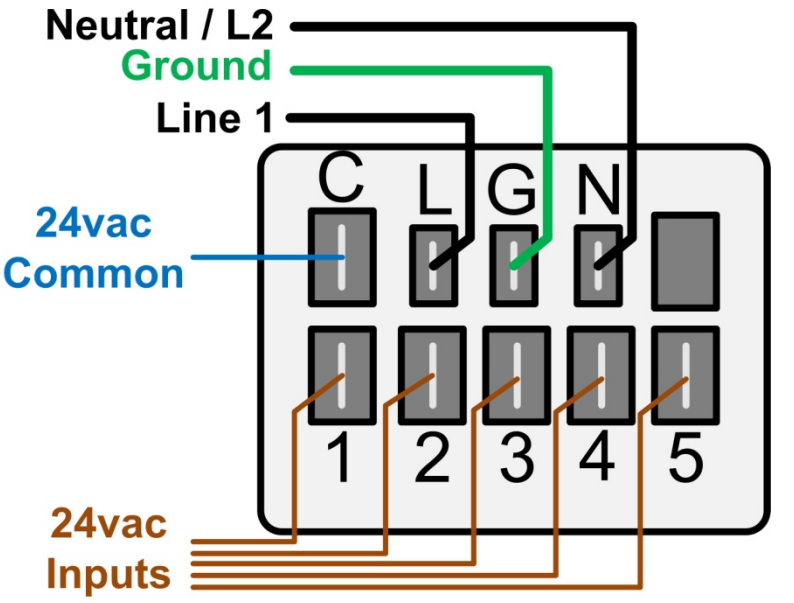
- Applications
  - HVAC Indoor Blower
  - Mid-tier systems

- Multi-tap
  - Output adjusted at the motor by selecting tap values
  - Tap values (torque) programmed by OEM to match unit specifications



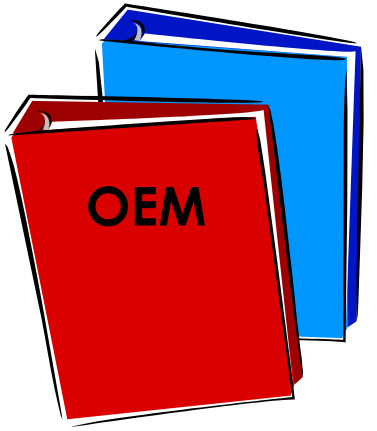
Multi-tap ECM

- Tap selection determines output
  - Similar to PSC motors
- Line voltage power supplied continuously
- Tap inputs provide on/off command and output (airflow) selection

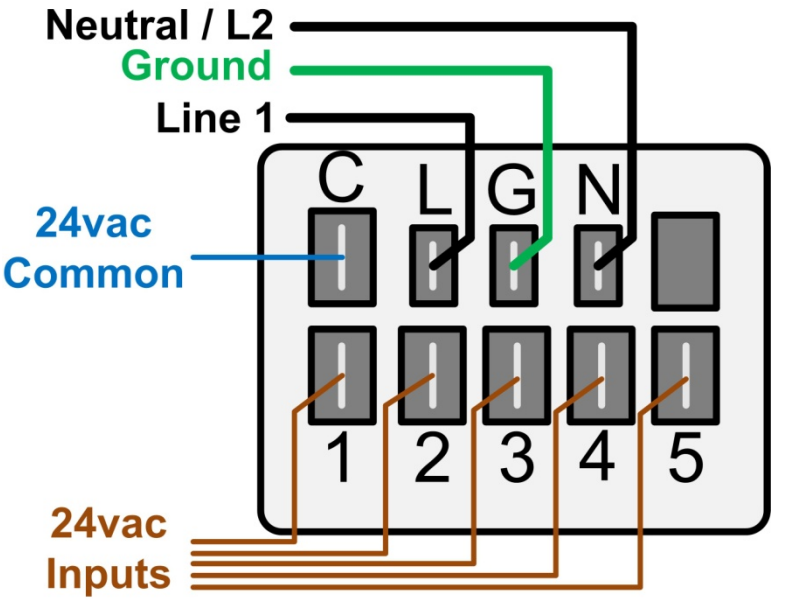


Installation set-up

- Select taps recommended by OEM
  - OEM manuals
  - Tap configuration unit schematic

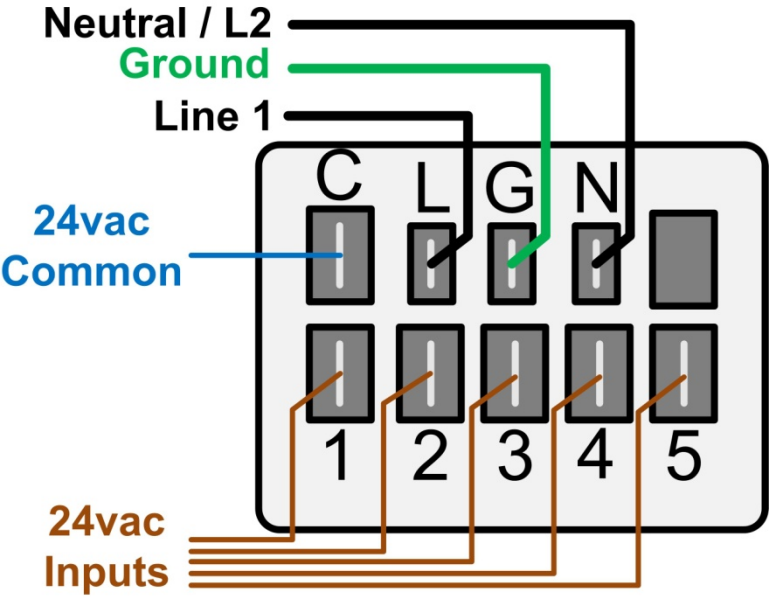


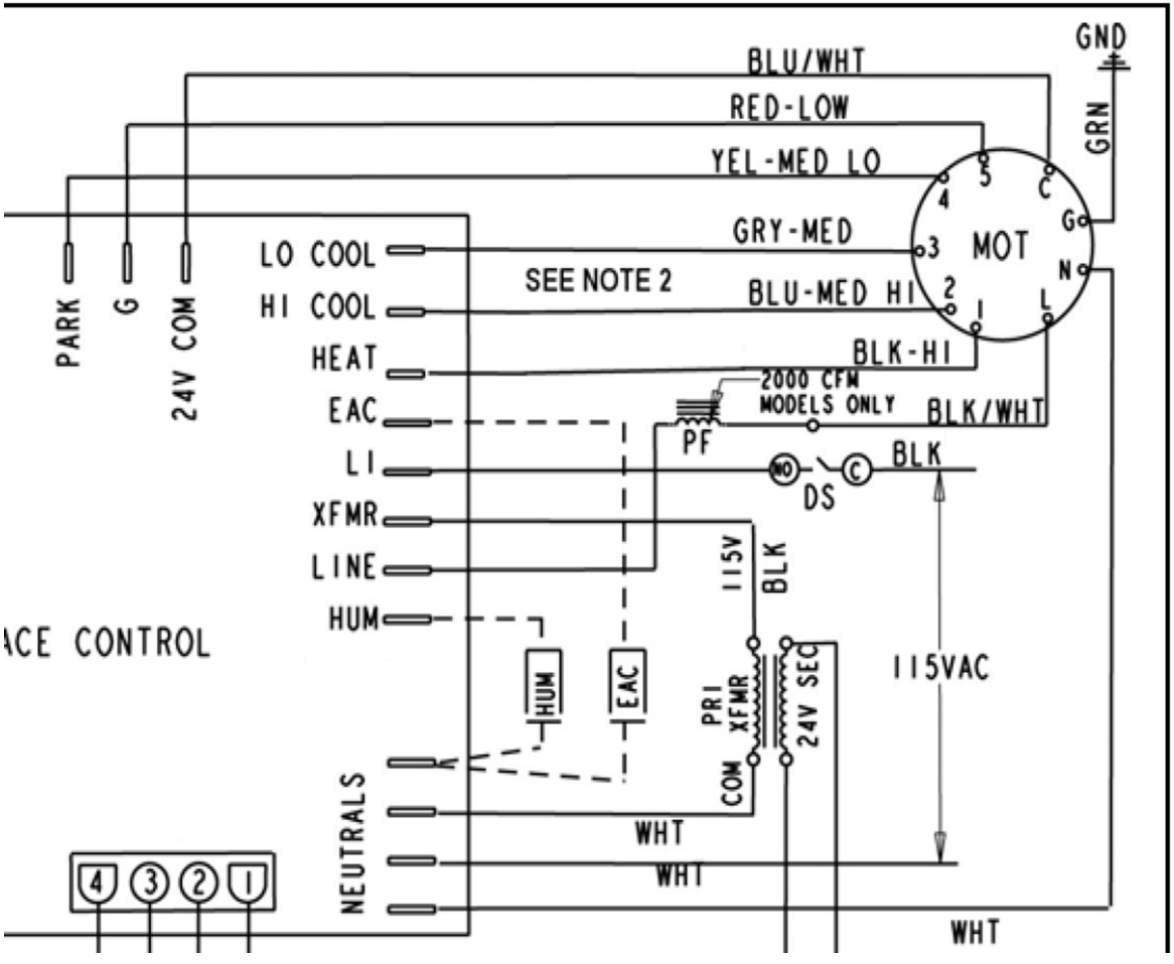
- Confirm airflow with TR or CFM measurement



Constant Torque OEM ECM

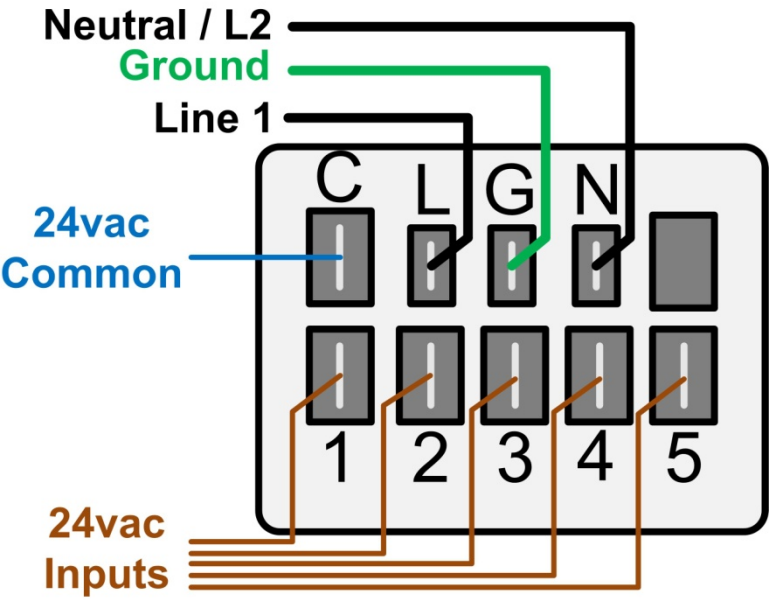
- OEM Programming examples

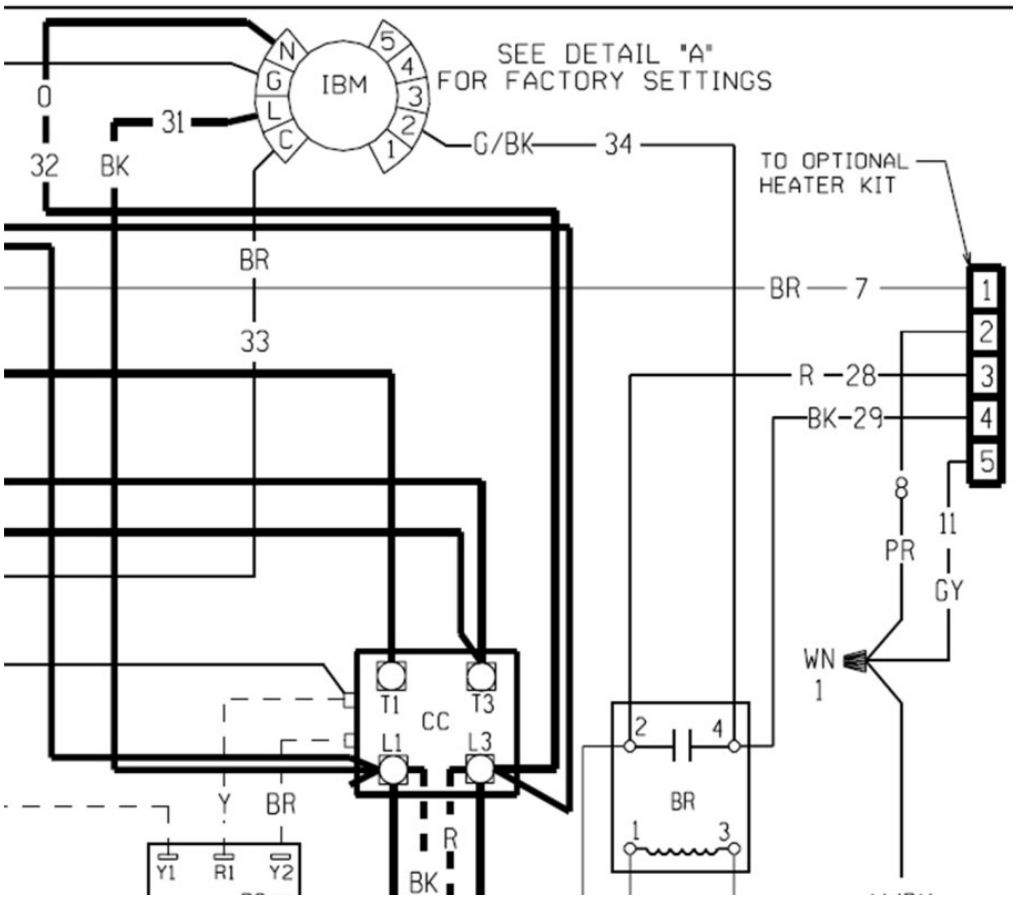




Constant Torque OEM ECM

- OEM Programming examples



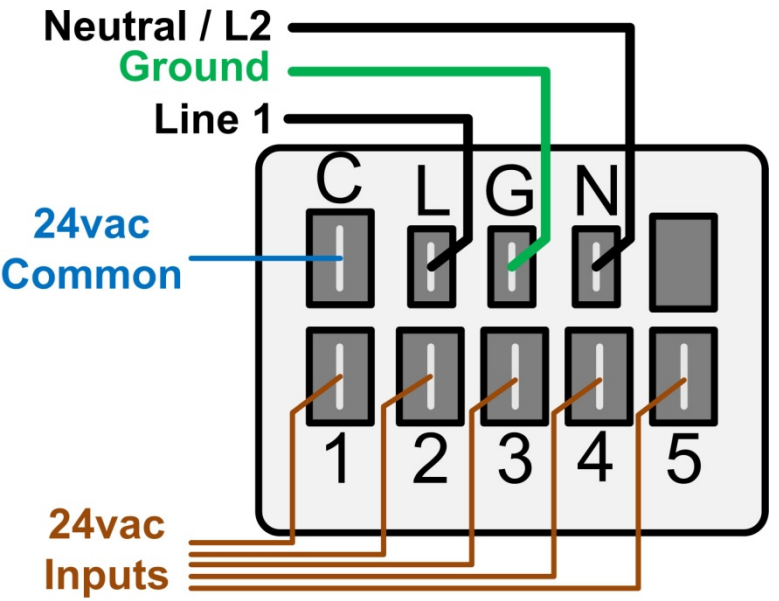


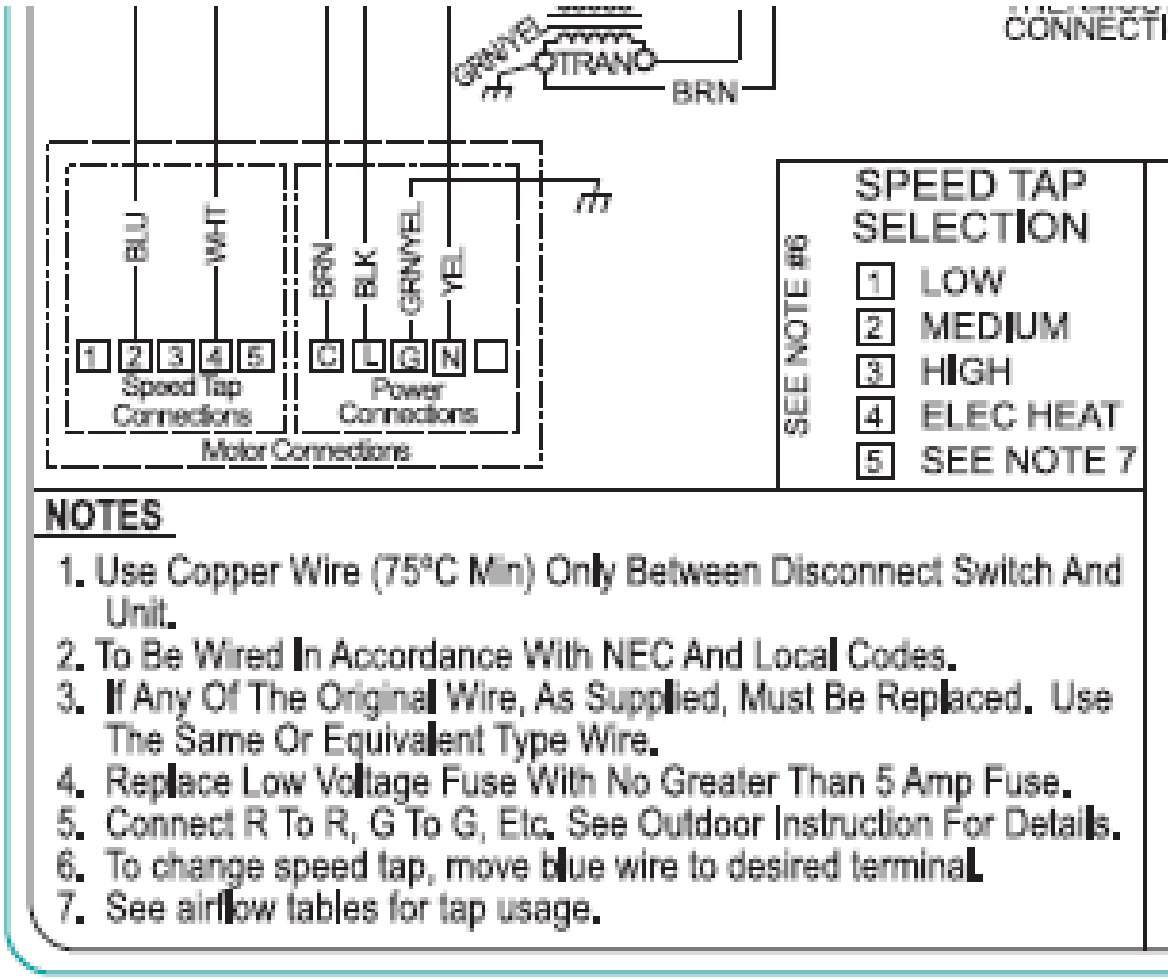
DETAIL " A"

NOMINAL COOLING CAPACITY	MOTOR SPEED FROM FACTORY		AVAILABLE SPEEDS
	HEAT	COOL	
2 THRU 5 TON	LOW (TAP 2)	LOW (TAP 2)	LOW (TAP 2)
			HIGH (TAP 1)

Constant Torque OEM ECM

- OEM Programming examples





Airflow (Why TESP is so important)

- Airflow is dictated by TESP
  - Similar to PSC
  - Factory default speed is not correct for all installations

- Higher TESP = Higher energy consumption & LESS AIRFLOW

- Continuous high TESP = Decreased Motor life

Constant Torque / OEM HVAC / Indoor Blower

This information is not found on the unit label

Table 1 – Airflow Performance (CFM)

MODEL & SIZE	BLOWER SPEED	EXTERNAL STATIC (in. wc)					
		0.10	0.20	0.30	0.40	0.50	0.60
FX4D 019	Tap 5	776	745	696	660	609	572
	Tap 4	683	644	589	548	494	461
	Tap 3	683	644	589	548	494	461
	Tap 2	631	563	500	443	409	361
	Tap 1	625	524	457	417	367	319
FX4D 025	Tap 5	956	920	891	851	816	780
	Tap 4	825	795	757	722	674	634
	Tap 3	825	795	757	722	674	634
	Tap 2	726	695	635	598	543	509
	Tap 1	631	563	500	443	409	361
FX4D 031	Tap 5	1189	1151	1104	1050	1003	959
	Tap 4	1041	998	944	886	837	772
	Tap 3	1041	998	944	886	837	772
	Tap 2	924	876	817	752	704	660
	Tap 1	779	693	628	571	526	476
FX4D 037	Tap 5	1363	1332	1294	1253	1207	1157
	Tap 4	1237	1206	1160	1121	1070	1013
	Tap 3	1237	1206	1160	1121	1070	1013
	Tap 2	1095	1058	1007	951	888	824
	Tap 1	1014	885	773	673	609	549
FX4D 043	Tap 5	1519	1490	1454	1419	1379	1332
	Tap 4	1437	1403	1366	1333	1294	1245
	Tap 3	1437	1403	1366	1333	1294	1245
	Tap 2	1257	1226	1191	1141	1090	1033
	Tap 1	1237	1206	1160	1121	1070	1013
FX4D 049	Tap 5	1757	1725	1693	1653	1614	1576
	Tap 4	1664	1626	1593	1552	1517	1477
	Tap 3	1664	1626	1593	1552	1517	1477
	Tap 2	1459	1420	1379	1336	1298	1259
	Tap 1	1301	1241	1195	1150	1102	1039

ECM Products and Applications (Overview)

Hz	Voltage	HP	PF	Motor Type
60	115	1/2	0.9	
High	Speed			

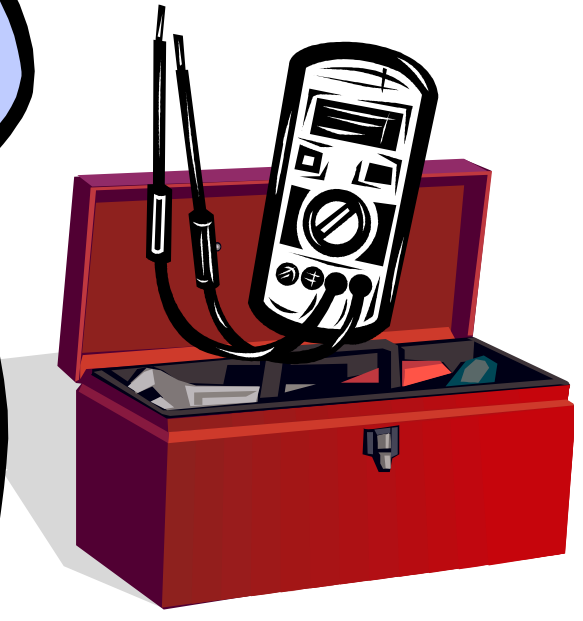
60	115	1/2	0.6	
Med	Speed			
High				

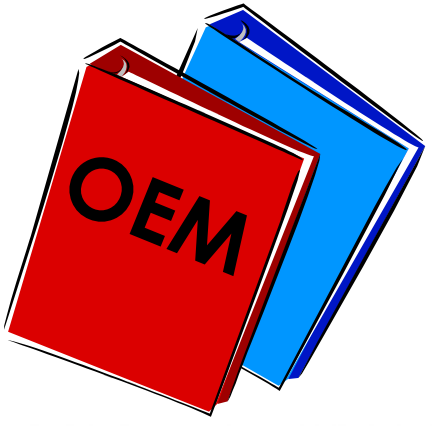
PSC (Induction Motor)				
TESP	0.3	0.5	0.7	0.9
CFM	1345	1261	1158	1038
Watts	700	667	628	576
Amps	6.69	6.47	6.1	5.71

ECM (Constant Torque)				
TESP	0.3	0.5	0.7	0.9
CFM	1318	1253	1182	1092
Watts	352	368	387	399
Amps	5.22	5.43	5.68	5.85

Data is from lab testing on one particular unit. Numbers may vary from one unit to another.

Servicing Constant Torque (multi-tap) Indoor Blower ECM





Diagnostics

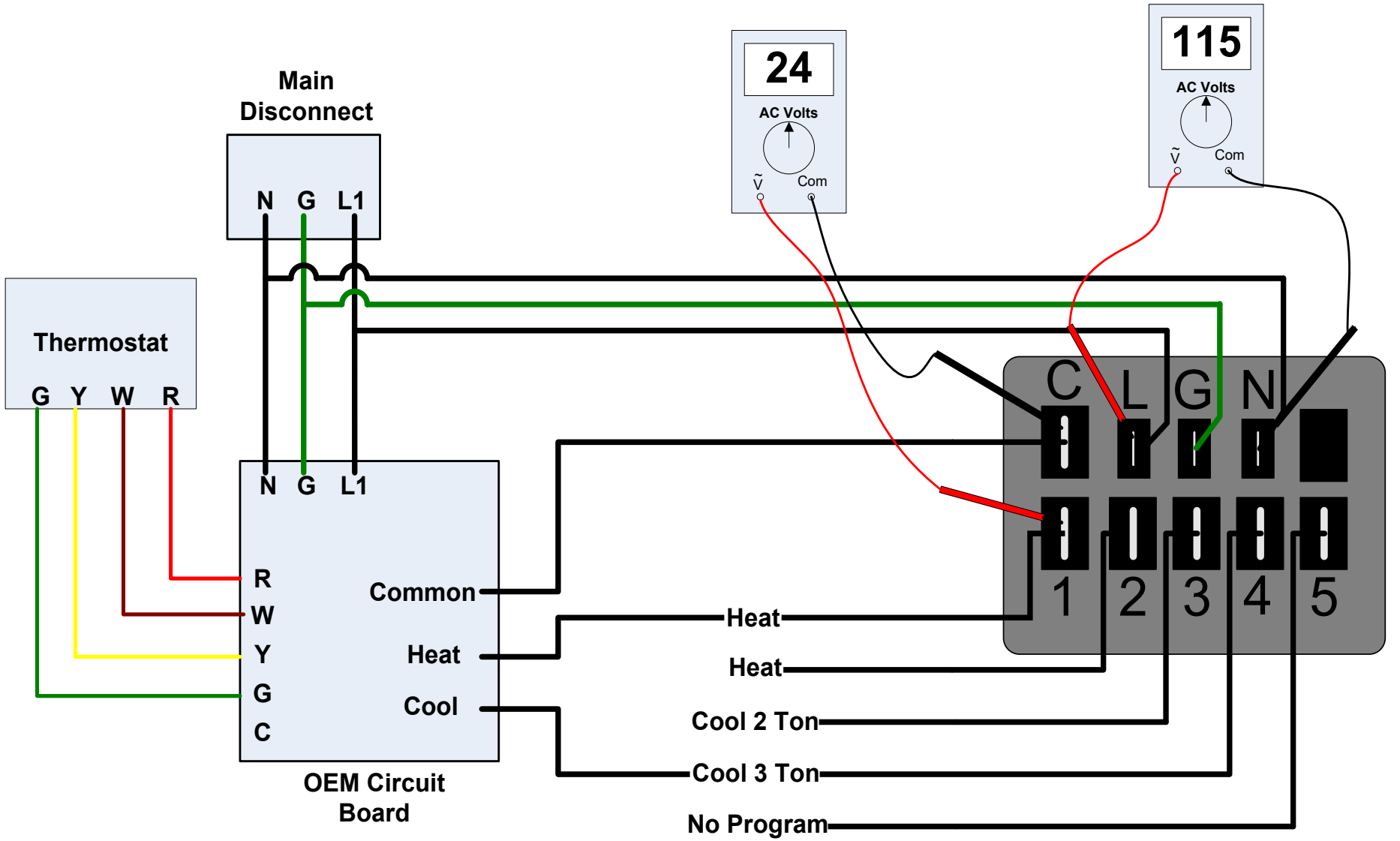
- Control Diagnostics
  - Line Voltage
  - Tap Voltage
- Motor Diagnostics
  - Ohms

All Genteq OEM ECM Indoor Blower Motor diagnostics are covered in the Genteq ECM Service Guide.

- Free download or order hard copy **TheDealerToolbBOX.com**
- **TheDealerToolBELT app**
  - Includes Genteq ECM Service Guide
  - Includes operation, diagnostic and replacement videos

Constant Torque / OEM HVAC / Indoor Blower

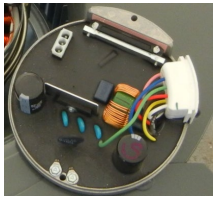
Voltage checks with individual wires.



Diagnostics

- If the motor does not operate with proper line voltage and communication voltage to a programmed tap:

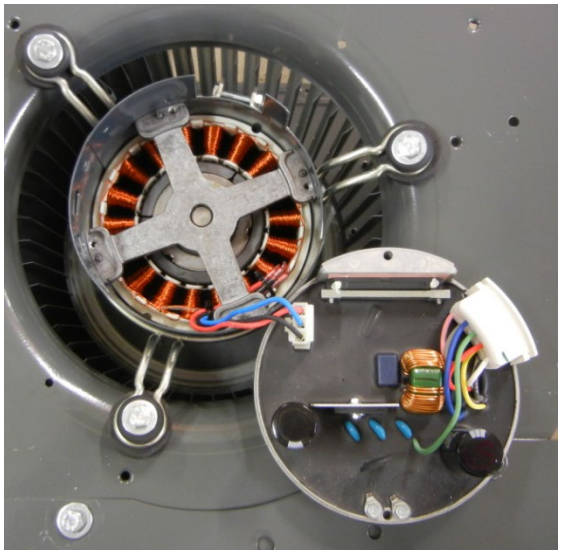
  - **Replace the motor control and motor** if the motor fails either ohm test or does not rotate easily by hand
    - Or if OEM only provides motor control and motor as one part

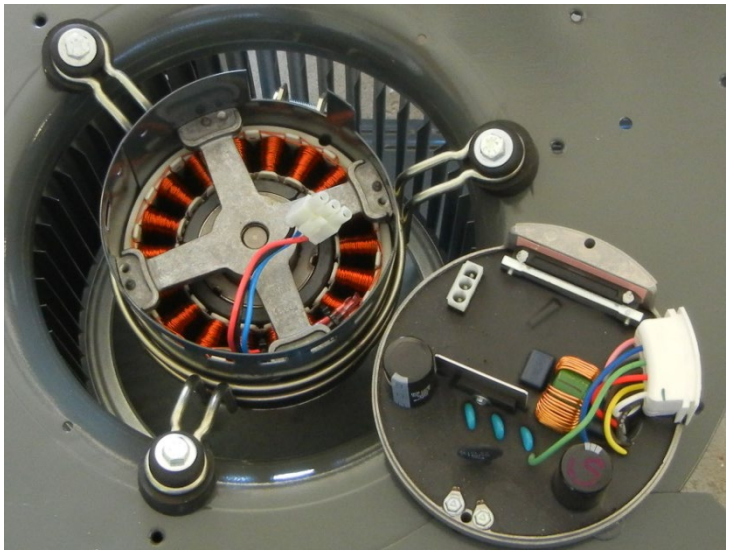


  - **Replace motor control only** if motor passes ohm tests and rotates easily by hand

Constant Torque / OEM HVAC / Indoor Blower

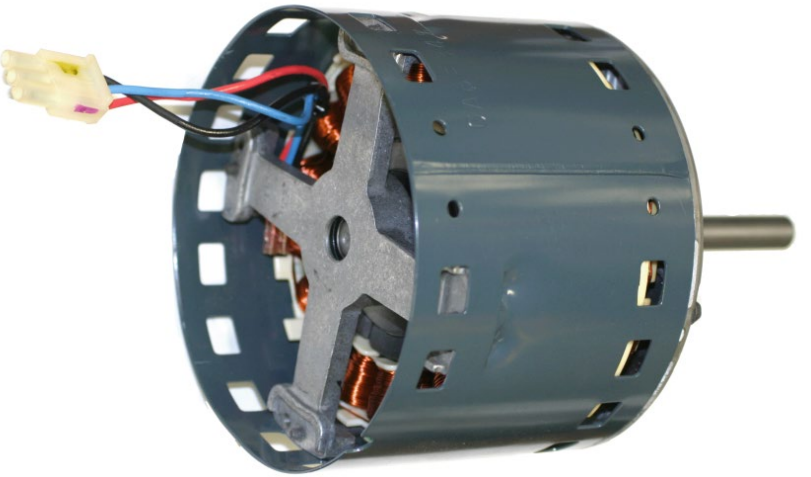
- **If the motor does not operate with proper inputs:**
  - Disconnect power to HVAC system
  - Wait 5 minutes
  - Remove motor control





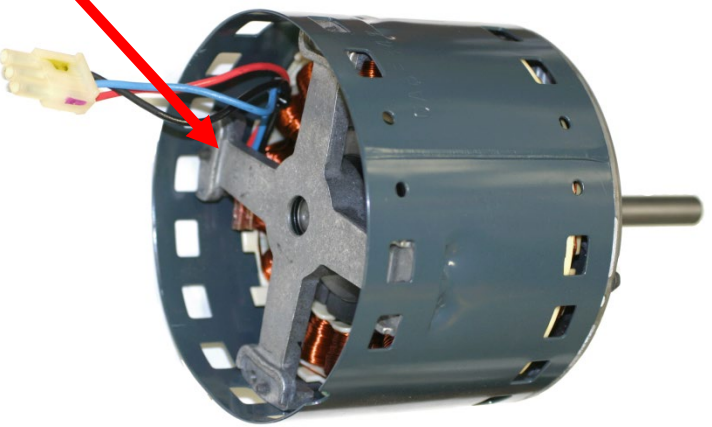
Constant Torque / OEM HVAC / Indoor Blower

- **If the motor does not operate with proper inputs:**
  - Perform ohm checks on motor
    - Same as Constant Airflow (Variable Speed) motor



Motor Module Tests

Test A – measure the resistance between each of the 3 motor leads to the X brace.

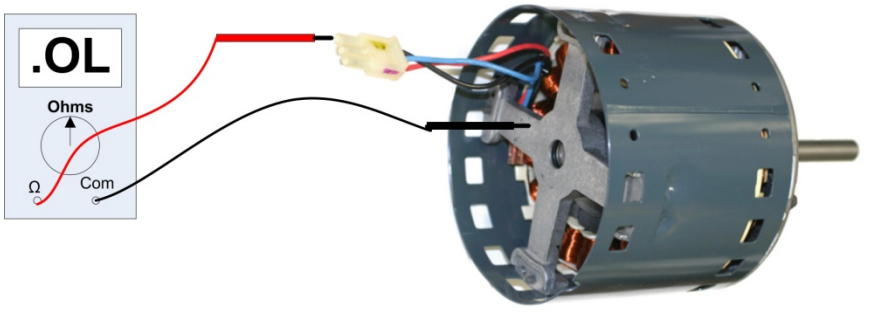


Constant Torque / OEM HVAC / Indoor Blower

Motor Module Test A (Winding to Ground Resistance)

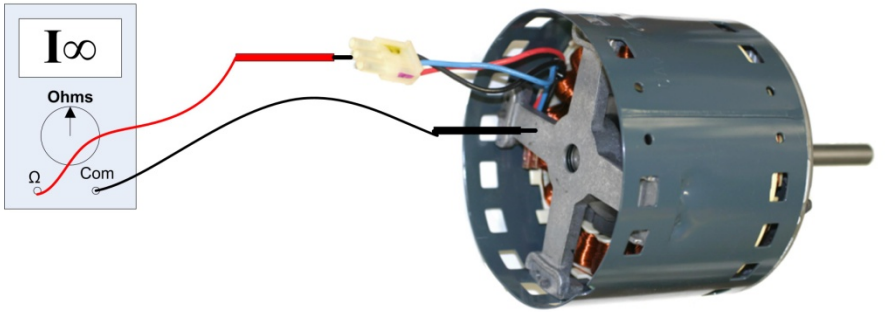
Lead 1 to Ground

Pass



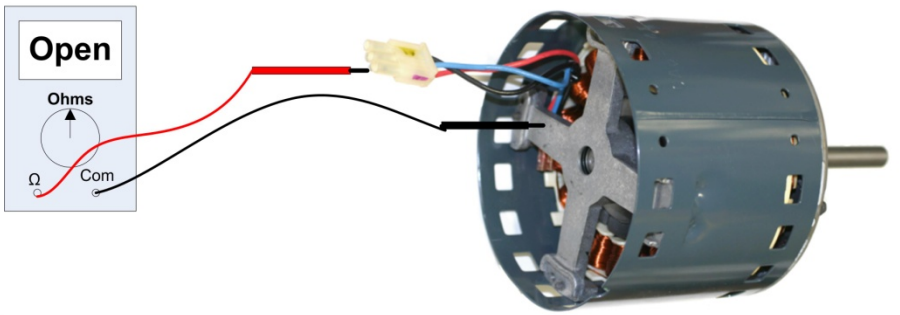
Lead 2 to Ground

Pass



Lead 3 to Ground

Pass



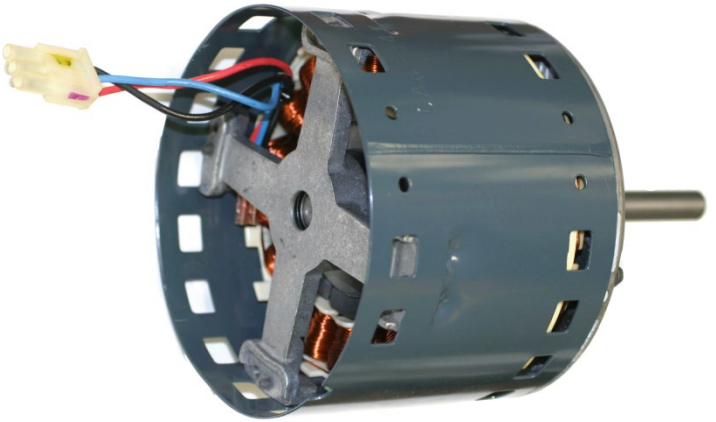
1. **The resistance from each winding lead to ground must be > than 100K ohms.**

Motor Module Tests

Test B – measure the motor phase-to-phase resistance by checking these combinations of the 3-pin motor connector with an ohmmeter. For the purpose of this test, start at either end of the connector as Lead 1.

1. **The lead to lead resistance across any two leads should be less than 20 ohms.**

2. **Each lead to lead resistance should be the same within ± 10%.**



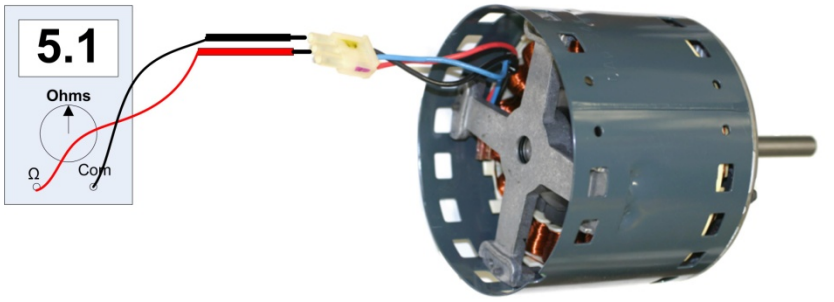
- Lead 1 to Lead 2
- Lead 1 to Lead 3
- Lead 2 to Lead 3

Constant Torque / OEM HVAC / Indoor Blower

Motor Module Test B (Phase to Phase Resistance)

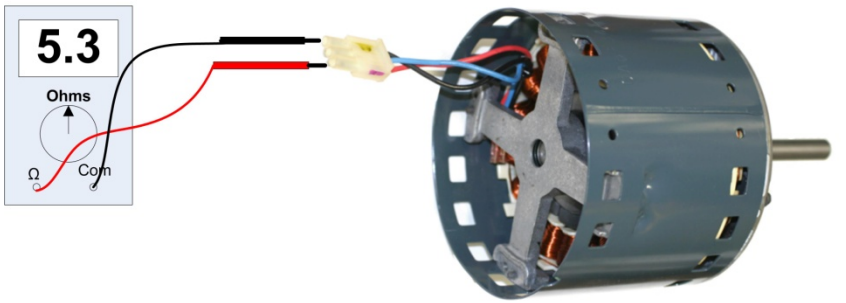
Lead 1 to Lead 2

Pass



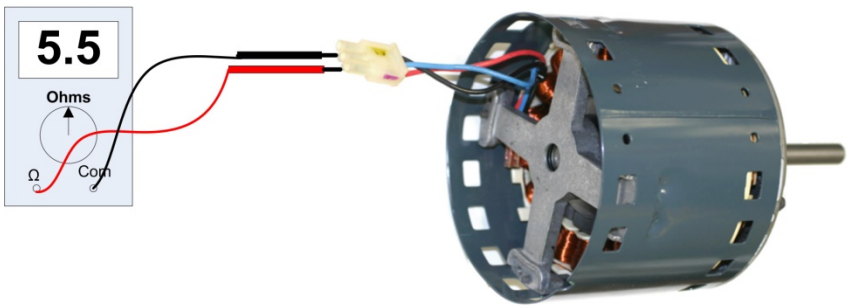
Lead 1 to Lead 3

Pass



Lead 2 to Lead 3

Pass



1. **The lead to lead resistance across any two leads should be less than 20 ohms.**

2. **Each lead to lead resistance should be the same within ± 10%.**

Constant Torque / OEM HVAC / Indoor Blower

- **If the motor module fails either test or is difficult to rotate by hand:**
  - Replace both the motor control and the motor

- **If the motor module passes both tests and is easy to rotate by hand:**
  - Replace the motor control only

Constant Torque ECM Wrap-Up

- One tool
  - Volt/Ohm Meter
    - Test the ECM Motor
- Four checks
- Accurate
- Saves Time
- Saves Parts Change-out
- Easily diagnose motor control and motor

Constant Torque / OEM HVAC / Indoor Blower

Repair

- **Programs are specific to HVAC OEM, model and size unit**
  - Replacement parts with the exact OEM program must come from HVAC OEM
  - Control replacement available
  - **NOT FIELD REPAIRABLE**
  - Using the wrong motor may void warranties
    - May produce unexpected results
  - Follow all instructions with replacement parts
  - **Generic replacements are available**
    - **Genteq Evergreen EM**

Constant Torque / OEM HVAC / Indoor Blower

Repair

- Prevent repeat failures
  - Most fatal damage caused by:
    - Water damage
    - Voltage Spikes
      - Add surge protection to homes in high risk areas
    - Operation at high Total External Static Pressure
      - Measure and correct if needed

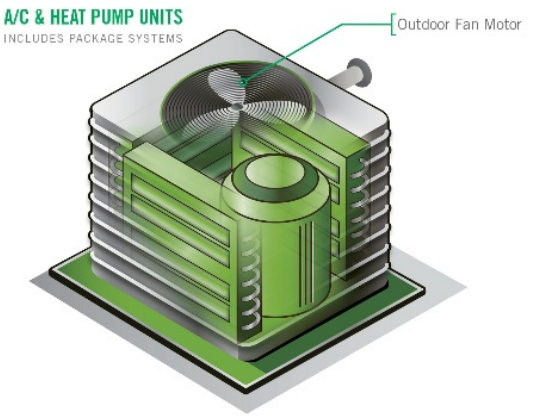
from e to Z

Constant Speed ECM

HVAC

Constant Speed ECM

- Applications
  - HVAC Outdoor Fan
  - Premium systems, 15+ SEER



- Multi-tap or communicated
  - OEM configured, no adjustments
  - Speed values programmed by OEM to match unit specifications

Constant Speed / OEM HVAC / Outdoor Fan

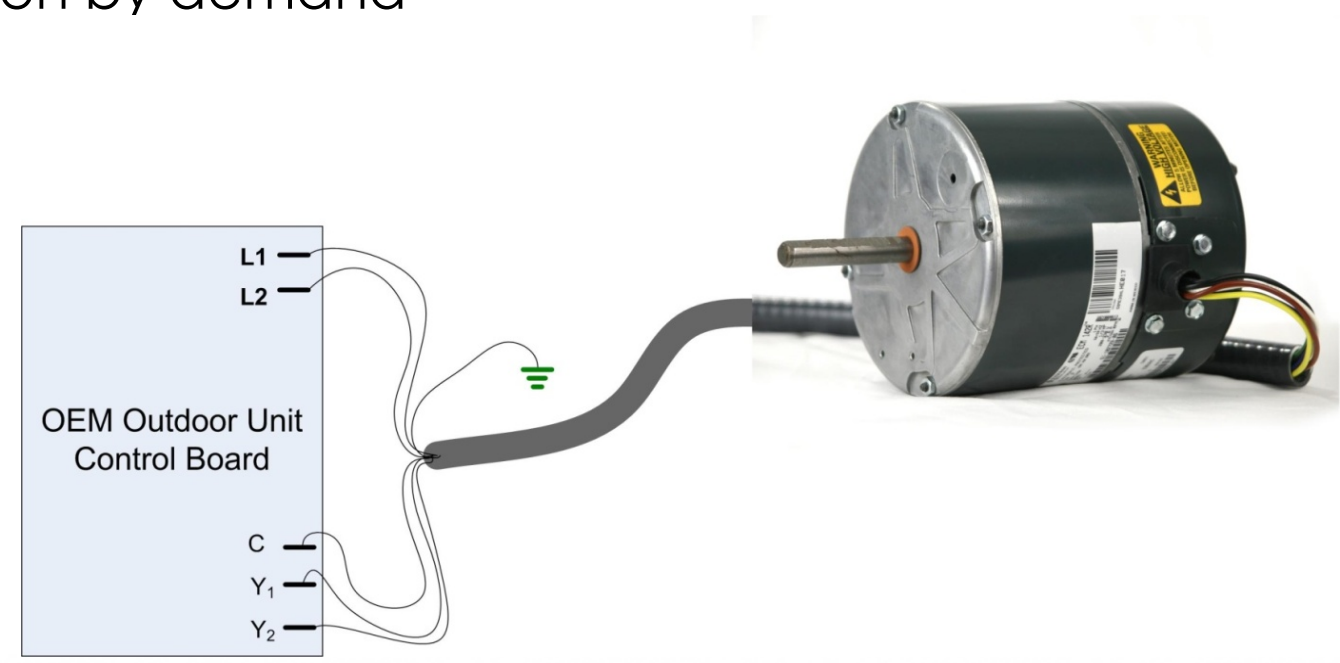
- **Unique Application**
  - Remotely located motor control

Constant Speed / OEM HVAC / Outdoor Fan

- **Operation**
  - 208-230vac continuous line voltage
  - A/C or DC communication
    - OEM specific
    - Speed per demand by OEM program
  - Constant Speed
  - Hardwired at motor
    - No plugs at the motor
    - Wire colors OEM specific

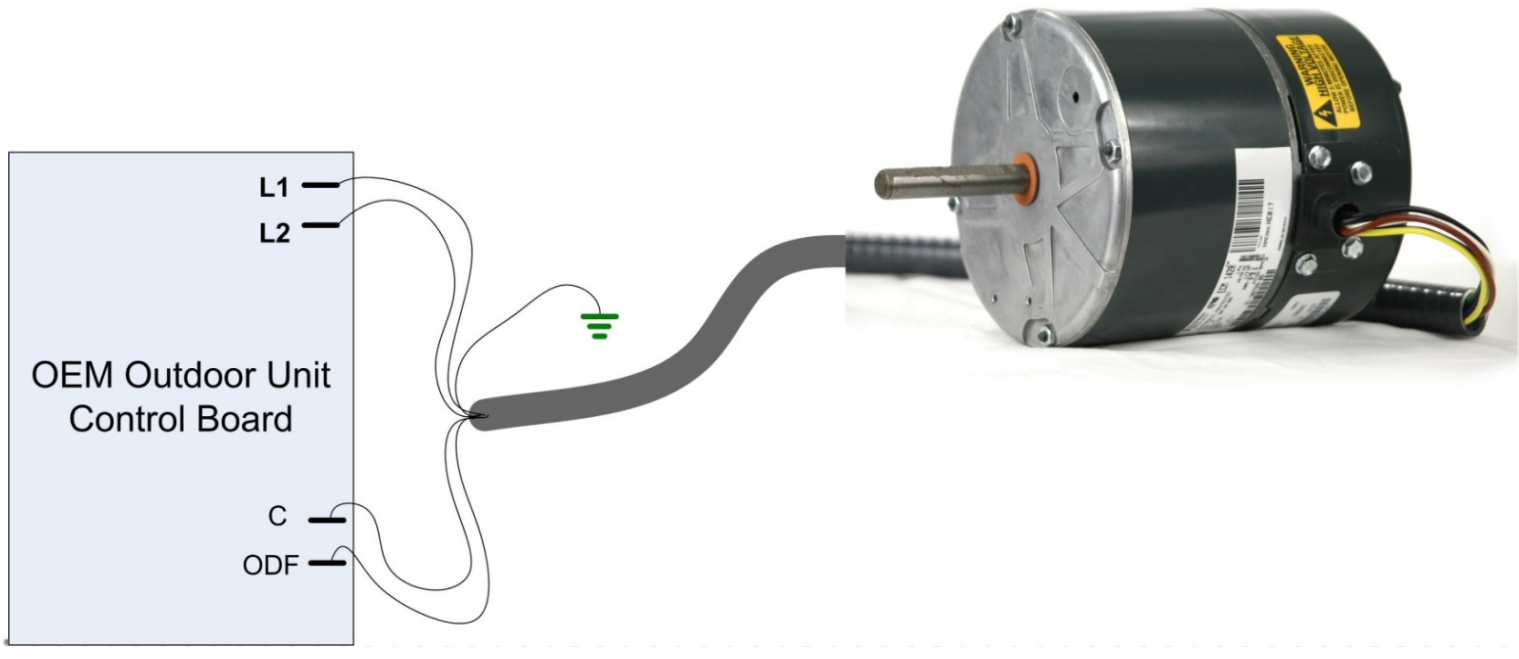
Constant Speed / OEM HVAC / Outdoor Fan

- **Operation**
  - **Two stage system – Two Speed**
  - 208-230vac continuous line voltage
    - Operates internal electronics and drives the motor
  - A/C communication
    - Speed selection by demand
    - 6 wires



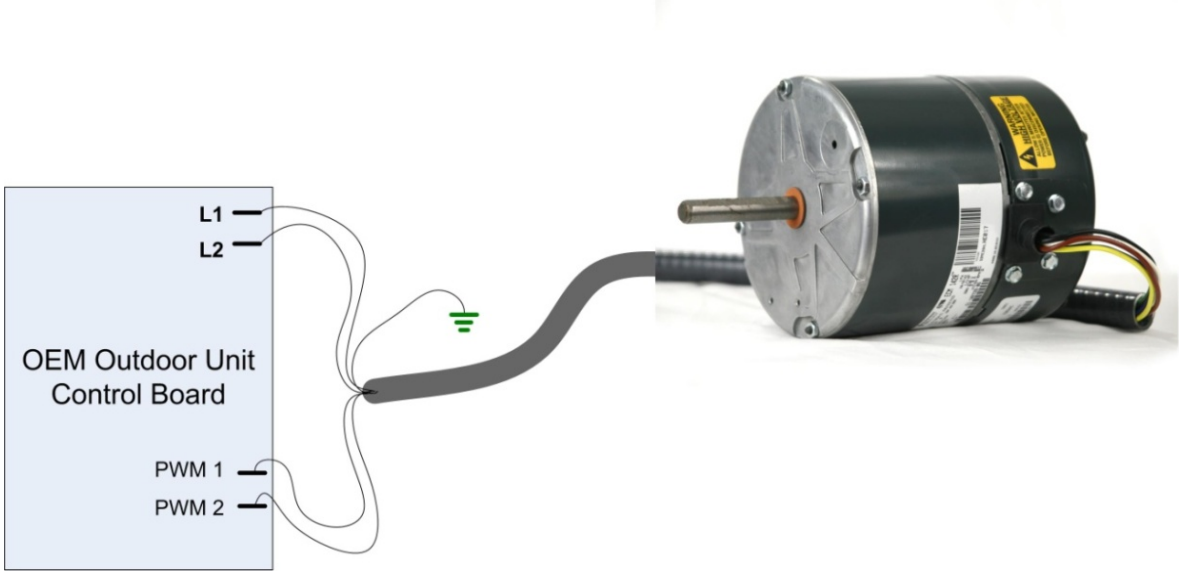
Constant Speed / OEM HVAC / Outdoor Fan

- **Operation**
  - **Single stage system – Single Speed**
  - 208-230vac continuous line voltage
    - Operates internal electronics and drives the motor
  - A/C communication
    - 5 wires



Constant Speed / OEM HVAC / Outdoor Fan

- **Operation**
  - **One or Two stage system - Communicated**
  - 208-230vac continuous line voltage
    - Operates internal electronics and drives the motor
  - D/C communication (PWM signals)
    - Speed selection by demand
    - OEM Manual
    - 5 wires

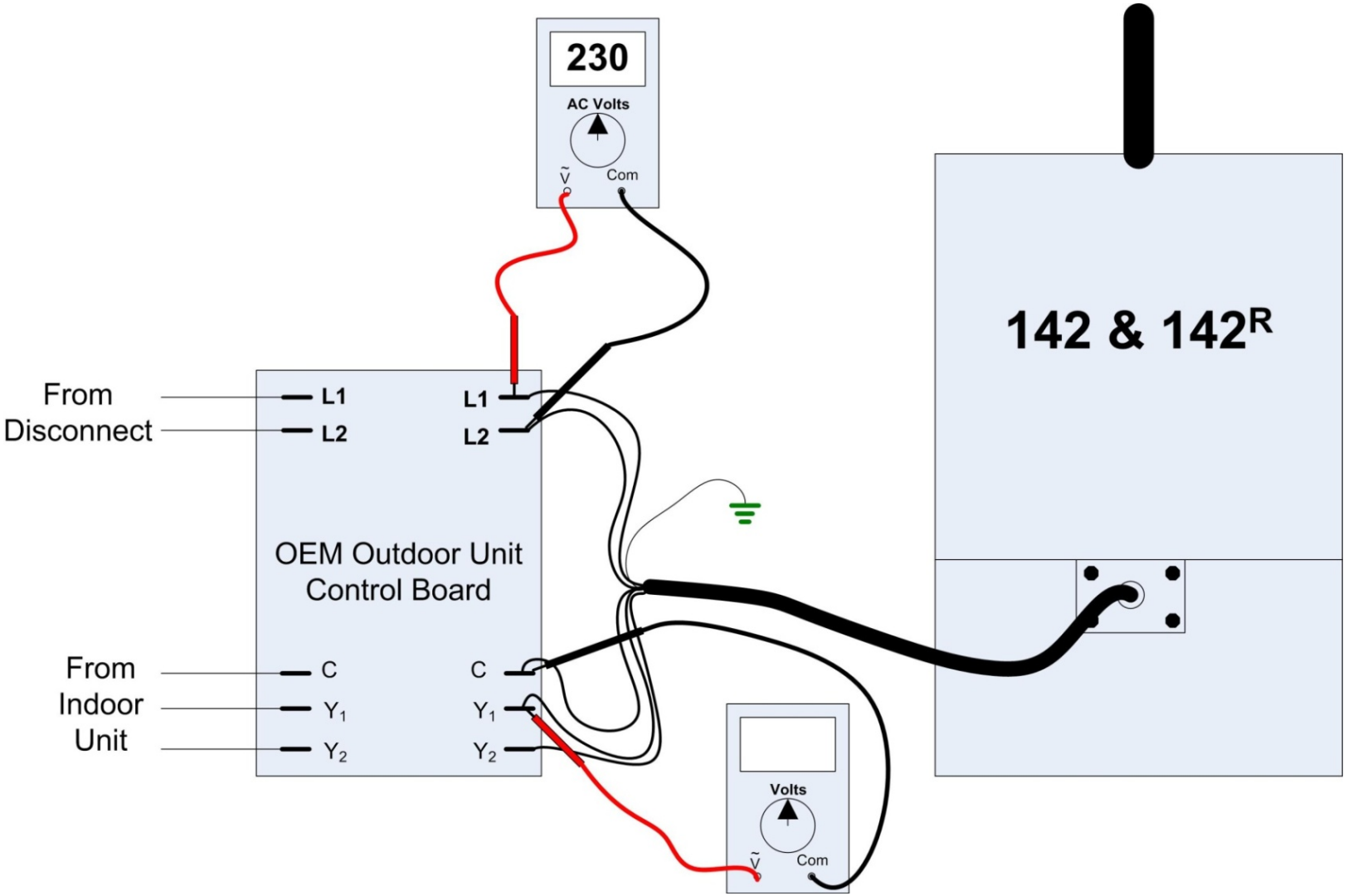


Constant Speed / OEM HVAC / Outdoor Fan

- **Installation/Set-up**
  - Typically no set up
  - See OEM manuals

- **Troubleshooting**
  - Line voltage continuously powered
    - Voltage within ±10% acceptable
  - Communication voltage by demand
    - OEM specific
    - Use OEM manual and/or schematic to confirm voltage

Constant Speed / OEM HVAC / Outdoor Fan



Constant Speed / OEM HVAC / Outdoor Fan

Repair

- **Programs are specific to HVAC OEM, model and size unit**
  - Replacement only available as motor and motor control
  - Replacement parts must come from HVAC OEM
  - No universal replacement parts, **NOT FIELD REPARIABLE**
  - Using the wrong motor voids all warranties
    - May produce unexpected results
  - Follow all instructions with replacement parts

from e to Z

Evergreen Overview

Aftermarket ECM

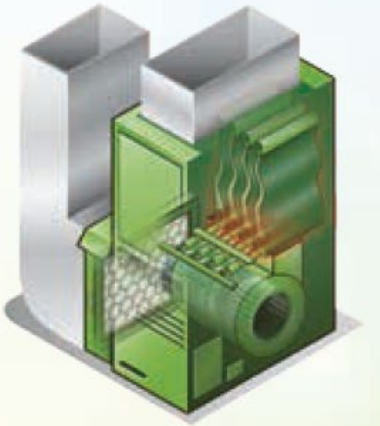
e•lab | education series | **HVAC/R** curriculum | genteq™

ECM Products and Applications (Overview)

HVAC MOTOR REPLACEMENT OPTIONS BY TYPE AND APPLICATION

INDOOR BLOWER MOTORS	REPLACEMENT OPTIONS			APPLICATION
 Induction Motor (Shaded Pole or PSC)	OEM PSC	Generic PSC	Evergreen IM Pages 4-5	FURNACE AIR HANDLERS
 Constant Torque ECM (Genteq models X13 or Endura Pro) or equivelant competitors product w/24vac speed taps	OEM motor control only part	OEM complete part (motor control and Motor)	Evergreen EM Evergreen CM Pages 6-9	
 Constant Airflow (Variable Speed) ECM (Genteq models 2.0, 2.3, 2.5, Eon & 3.0)	OEM motor control only part	OEM complete part (motor control and Motor)	NO GENERIC/ RETROFIT PARTS AVAILABLE	

OUTDOOR FAN MOTORS	REPLACEMENT OPTIONS			APPLICATION
 Induction Motor (Shaded Pole or PSC)	OEM PSC	Generic PSC	Evergreen OM Pages 10-11	A/C & HEAT PUMP UNITS INCLUDES PACKAGE SYSTEMS
 Constant Speed ECM (Genteq models 142 & 142R)	OEM motor control only part NOT AVAILABLE	OEM complete part (motor control and Motor)	NO GENERIC/ RETROFIT PARTS AVAILABLE	

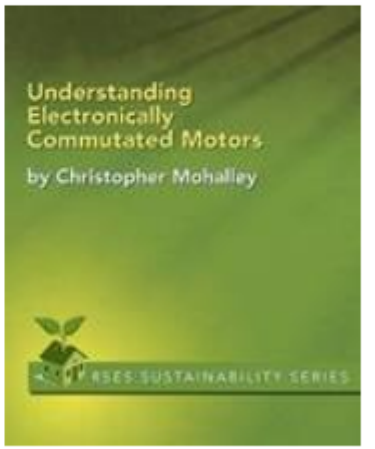


OEM = Original Equipment Manufacturer (Manufacturer of the HVAC Furnace/Air Handler/Package System)

Education Support

Thumb Drive

- **Training Tools**
  - ECM Service Guide and diagnostic tool
  - Understanding Electronically Commutated Motors (book)
  - Video Training
  - Dealer Tool Belt App



Closing Thoughts

Remember that the happiest people are not those getting more, but those giving more.

- H. Jackson Brown Jr

Thank you for your dedication to education!