ECM TROUBLESHOOTING

ECM Motors Overview

With the new FER (FAN ENERGY RATING) law that is now in place, we strongly encourage getting familiar with the ECM motor. The Department of Energy (DOE) has mandated a change for motor efficiencies. In summary, there is a formula that takes the energy rating from a fan in different modes (heating, fan, cooling); the closer the energy ratings per mode, the higher the FER rating. What this means is an end to PSC furnace motors that will be replaced with ECM motors.

TROUBLESHOOTING ECM MOTORS

Variable Speed or Constant CFM:

These motors are not new to the industry. In fact, they've been around for quite some time. This document focuses on ECM 2.3 and 3.0. ECM 2.3 has a 16-pin control wiring harness running from the board to the motor. ECM 3.0 is a communicating motor that consists of four (4) control wires connecting the board to the motor. Both of these motors will have a high voltage harness as well.

ECM 2.3 Troubleshooting:

- What is the motor doing or not doing? For this motor to operate, make sure you have the voltage necessary to turn it on. Let's assume the motor is not responding for a fan call.
  - If the motor is not operational, make sure you have a "G" or "Fan" call. This will be a 24vac reading between "G" and "B/C" or ground.
  - Also confirm you have 120vac to the motor itself; without these voltages the motor will not operate!
- If your 120vac high voltage is on the motor and 24vac demand for a fan is present on the IFC (Furnace Board), look further into the motor and board.
  - Inspect the 16-pin wire harness between the board and the motor. Is it in good shape? Confirm this by ohming the harness wire for wire, end to end.
    - If you find a pinched wire, cuts or scrapes, or a loose pin in the molex, replace the harness.
- After confirming the necessary voltage and that the harness is in good shape, check the motor and module by performing what we call a, "Go-No-Go Test".
  - Take the molex plug for the motor harness off the IFC (furnace Board).
  - Secure some paper clips or small thermostat wire to make a jumper. If you have an ECM motor tester, skip this test and follow the procedures for your ECM tool.
  - Add a jumper between pin 1 and 3 – see image below.
  - Add a jumper between 12 and 15 – see image below.
  - Apply 24vac COMMON to the 1-3 jumper.
  - Apply 24vac HOT to the 12-15 jumper.
  - Does the motor run? If so, the problem more than likely lies in the board.
  - If the motor does not run, you will need to investigate the motor and module.

- To inspect the module, remove the wire harnesses and blower housing to get access to the motor and module.
- Remove the screws holding the module to the motor.
- Remove the plug harness that internally connects the module to the motor.
  - Ohm the motor like a 3-phase motor. These ohm values should be nearly identical but may have up to ±10% difference.
    - Red to blue
    - Red to black
    - Black to blue
  - If your ohm readings are outside ±10% then your motor is outside of spec.
    - Example: L1 to L2 = 10.4 ohms; L2 to L3 = 10.5 ohms; L3 to L1 = 14 ohms.
  - Now confirm there is not any continuity between the motor windings and the motor shell.
  - If your motor ohms properly, spins freely, and does not have continuity to ground then focus on the module itself.
- Does the module have a black, quarter-sized thermistor? If not, you're looking at a module replacement.

  Notes:
  - More than likely the motor is not the issue. These motors rarely fail.
  - A heating call does not need to see a "G" call from the thermostat, this is done internal to the IFC.
  - Cooling calls need to provide a "G" and a "Y" call to the board for proper cooling speeds.
  - The TecMate Pro ECM tester can test both ECM 2.3 and 3.0 ECM motors.

## ECM 3.0 Troubleshooting - S9V2, TAM8, TAM9, *UHM:

- Does the motor have 120vac?
- Did we confirm there is a call for "fan" or "G"?
- Are you getting a blower communication fault?
  - We will cover this another day!
- We can still use the "Go-No-Go Test" for these motors:
  - Remove the plug for the motor off the IFC (furnace board).
  - Take small wire or paper clip and insert into pins three and four.
  - Apply 24vac hot and common to pins 3 and 4.
    - Does the motor work? Confirm harness and connections.
  - Most, if not all, ECM 3.0 motors with Trane and American Standard will be a one-piece motor. This means the module and motor are combined and replaced as one whole piece.

ECM 2.3 (16-pin) Jumpers

2. Unplug 16 wire low voltage harnass from the motor control board. Jumper 24 V.A. C., to pins #12, #15 and common pins #1 and #3. Does the motor run?

NO: Go to step #3.
YES: Replace the motor control board on Air handlers, or Package units.
On Gas Furnaces, which use a CNT02223 furnace ignition control and a plug on the motor control board CNT01537, go to step #5. Furnaces with ignition controls which have the motor control built in, replace the furnace ignition control.
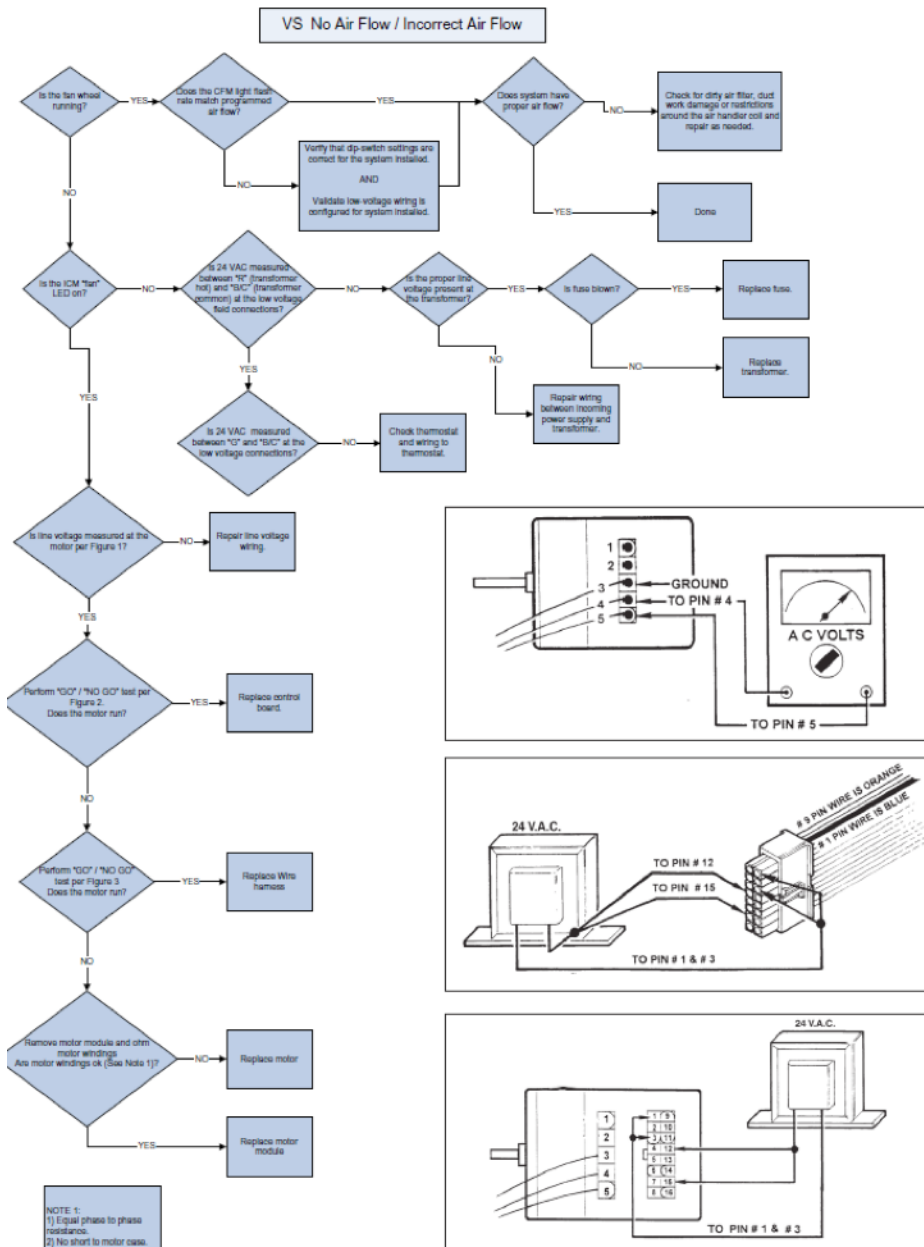
24 V.A.C.

TO PIN # 12
TO PIN # 15
TO PIN # 1 & # 3

9 PIN WIRE IS ORANGE
1 PIN WIRE IS BLUE
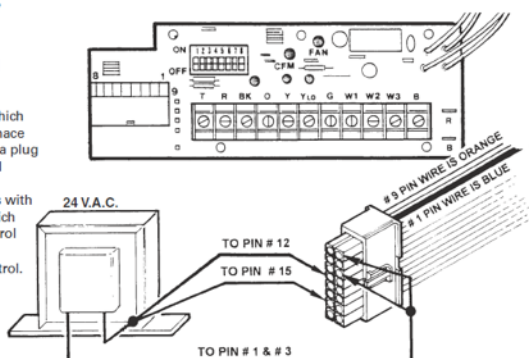
Paper clips in place for jumper test

Thermister in ECM 2.3 Module
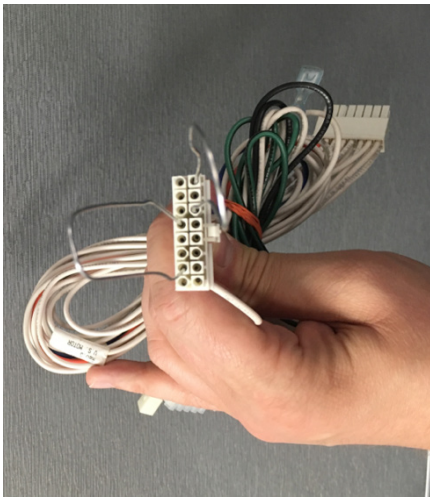
*UH2 or *UY furnaces – Two-stage Variable Speed Legacy Furnaces

*UHM, *UH3, TAM7,8,9

10 Flash Fault LED

Scroll through User Interface to View number 1 of Last 4 Faults

See next page for additional 10 flash faults

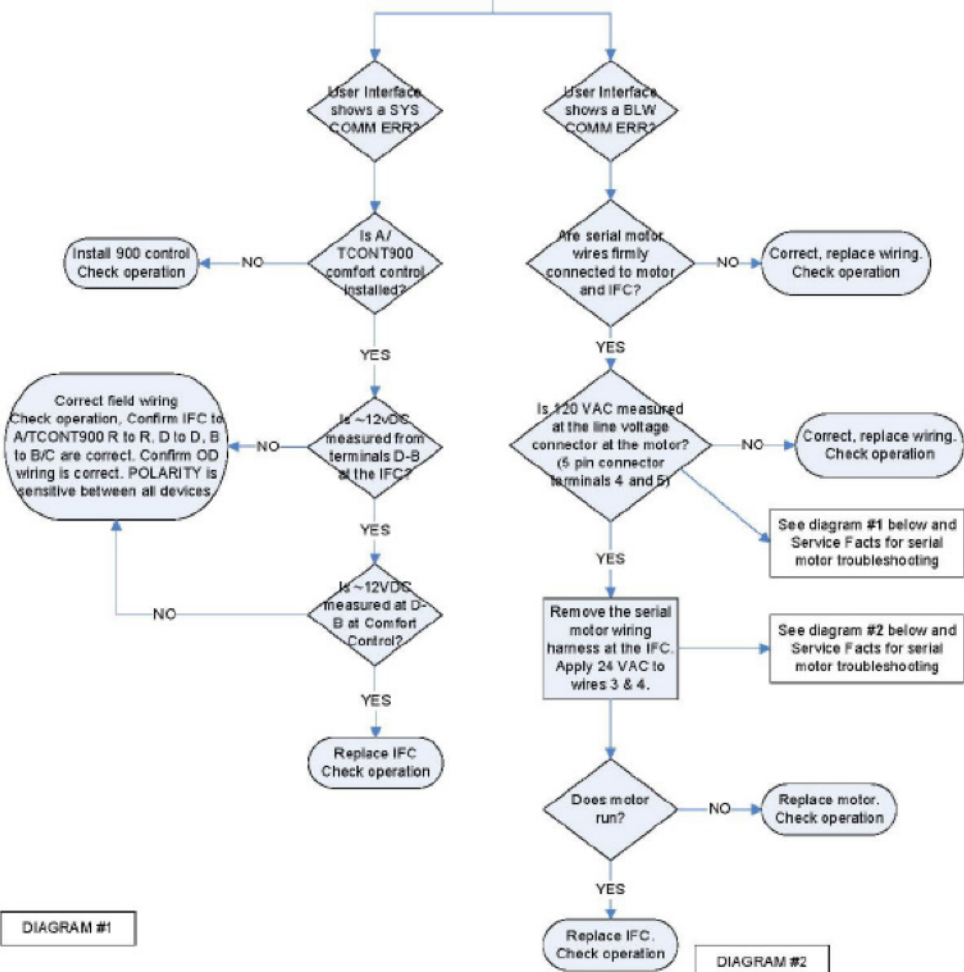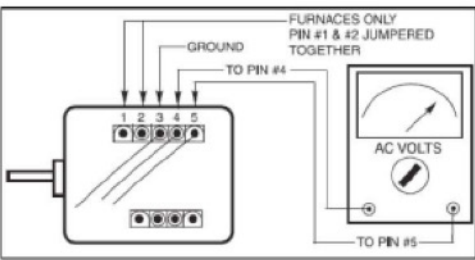User Interface shows a SYS COMM ERR?

User Interface shows a BLW COMM ERR?

Is A/TCONT900 comfort control installed? — NO → Install 900 control Check operation

Are serial motor wires firmly connected to motor and IFC? — NO → Correct, replace wiring. Check operation

YES

Is ~12vDC measured from terminals D-B at the IFC? — NO → Correct field wiring Check operation, Confirm IFC to A/TCONT900 R to R, D to D, B to B/C are correct. Confirm OD wiring is correct. POLARITY is sensitive between all devices

Is 120 VAC measured at the line voltage connector at the motor? (5 pin connector terminals 4 and 5) — NO → Correct, replace wiring. Check operation

See diagram #1 below and Service Facts for serial motor troubleshooting

YES

Is ~12VDC measured at D-B at Comfort Control? — NO →

Remove the serial motor wiring harness at the IFC. Apply 24 VAC to wires 3 & 4.

See diagram #2 below and Service Facts for serial motor troubleshooting

YES

Replace IFC Check operation

Does motor run? — NO → Replace motor. Check operation

YES

Replace IFC. Check operation

DIAGRAM #1

FURNACES ONLY
PIN #1 & #2 JUMPERED TOGETHER
GROUND
TO PIN #4
1 2 3 4 5
AC VOLTS
TO PIN #5

DIAGRAM #2

#3 = BLUE wire, connects to TX
#4 = WHITE wire, connects to GND

LVTB 24 VAC
B
R

MOTOR LOW VOLTAGE PLUG