

## York Central Tech Talk

Ideas, information, & Tech Tips

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### ECM Motor Troubleshooting – Part 1

Posted on [September 14, 2012](#)

16 Votes

If you read my last post on “*What is an ECM Motor?*” you should have a basic understanding of how an ECM motor works. As promised, we will now talk about how to *troubleshoot* equipment with ECM motors. This will be presented in 3 parts so make sure you don’t miss any of them.

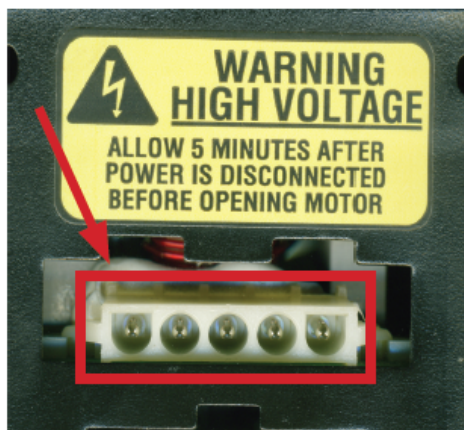
Troubleshooting the ECM motor can be very simple if you just remember that it not just *ON or OFF*. There are basically 4 problems that will not allow the motor to run:

1. There is no input *power* to the motor controller (high voltage input).
2. There is improper or no communication to the motor (low voltage inputs). This problem could be the CFM Programming control or board or the low voltage connector (wiring harness).
3. The motor controller (module) has failed.
4. The motor has failed (least likely of all the problems)

Too often, technicians “*assume*” the motor has failed because it is not running.

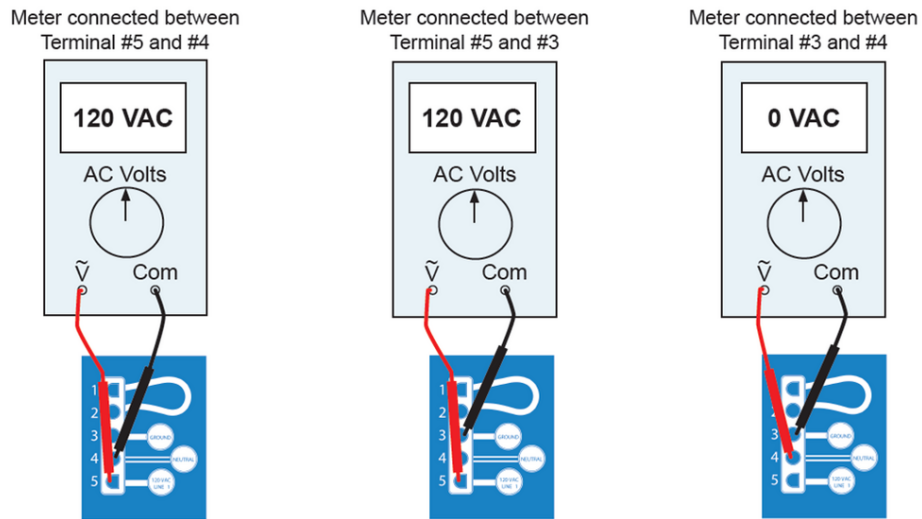
So let’s take each problem and see how to check that out.

- No power to the motor — We need to verify that the motor and module are getting the 110 (or 220) volts to it. The power comes into the module on the 5 pin plug. If there is a jumper between pin positions 1 & 2, the motor is set up to operate on 110 volts. If there is no jumper between pin positions 1 & 2, the motor is set up to operate on 220 volts. First, disconnect power to the system. Then remove the 5 pin connector from the module. With the plug removed, turn the power back on. now, check for proper power at the plug



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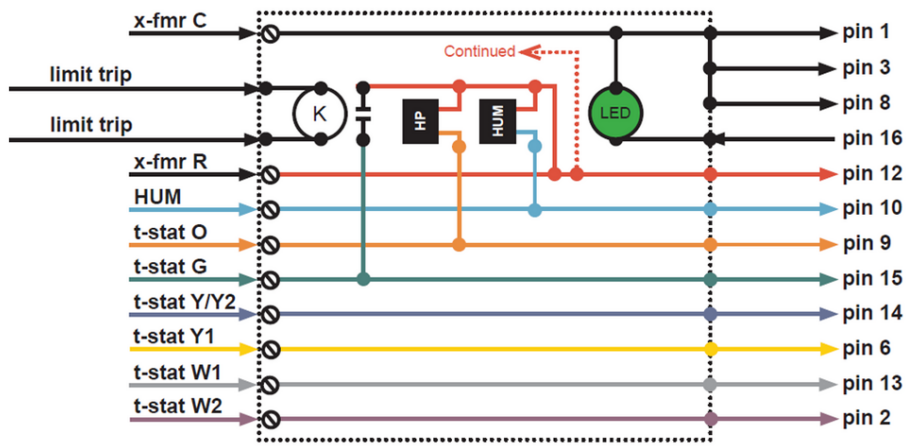
With the main power restored, you should be able to read the power at the 5 pin connector. (Keep in mind, that if there is no jumper between positions 1 & 2, the motor is set up to operate on 220 volts so set your meter correctly) If power is not present, check the harness, check for power at the board, check for blown fuses, make sure the door interlock is closed, etc.

After all the input voltages have been confirmed or corrected, you need to turn off the power to the unit and reconnect the 5 pin plug back onto the module. The plug must be connected all the way and locked into place to prevent arcing. If it is not fully connected and the locking tabs on the end are not “clicked” into place, vibration could cause the plug to move and break the power connection to the module.

Also, to ensure proper operation and safety, the motor must have a properly grounded connection from the 5 pin connector to ground. This is verified by reading from pin 3 (ground) and the unit chassis. You should read 0 resistance with an ohm meter.

- Now we have verified that we have line voltage to the motor but is still in not running. The next step is to verify that we are getting *communication* from the unit control or CFM Programming board. This involves checking the 16 pin harness to the module. In this part of the troubleshooting, you need to know the “orientation” of the plug. This is done by looking at where the “index” tab is on the plug. Now you can start to check to see if the control or CFM programming board is sending the proper signals.

ECM motors used in “standard” equipment operate in “*thermostat mode*” meaning that 24 volts is sent to various pins on the 16 pin harness plug based on the system *mode of operation*. By this, I mean, what is the thermostat calling for — heat (1st or 2nd stage), cool (first or second stage), fan only, heat pump cooling, dehumidification (reduced blower speed), etc? Once you know what mode of operation you are in, you can now see if the board or control is sending out the proper communications to the motor module.



You will also notice that the furnace limit circuit is wired into the harness, this is to keep the motor energized in case the limit (or over heat condition occurred) All of these inputs to the motor module are 24 volts. So, how do you know which pin to choose if you are checking for proper communications? Here is the “decoder ring” for the plug:

“O” - ORANGE	<u>9</u>	<u>1</u>	BLACK - common
“HUM” - BLACK	10	2	WHITE - “W2”
heat programmed input - BROWN	11	3	BLACK - common
“R” - RED	12	4	RED - delay programmed input
“W1” - BROWN	13	5	WHITE - cool programmed input
“Y2” - YELLOW	14	6	YELLOW - “Y1”
“G” - GREEN	15	7	PURPLE - adjust programmed input
motor speed feedback - YELLOW/ BLACK	<u>16</u>	<u>8</u>	BLACK - common

Note the “indexing tab” on the right side middle. This will give you the proper orientation to check the pins as needed.

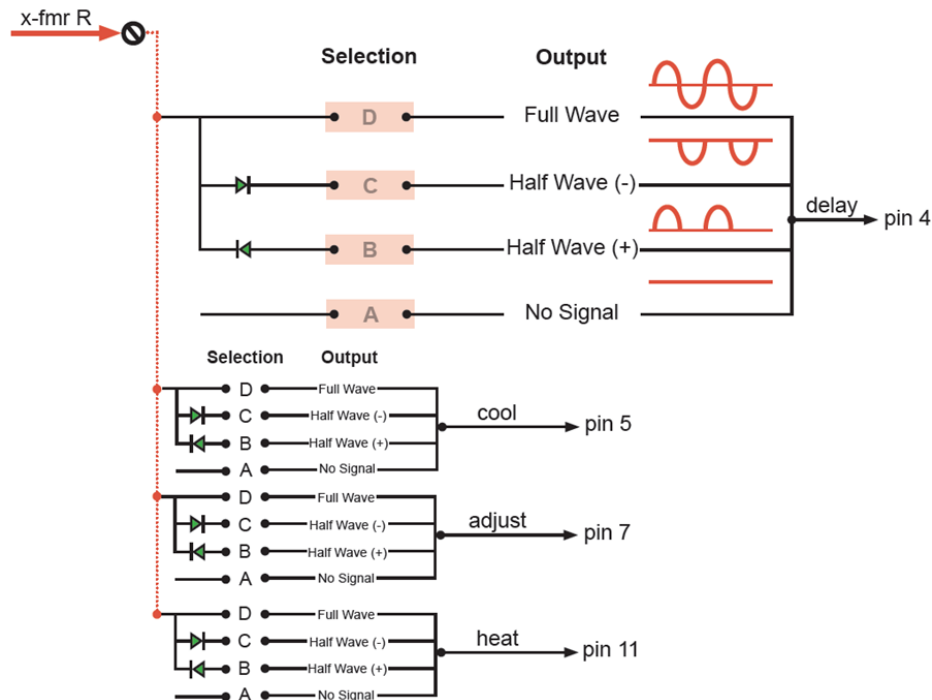
As an example, if you have a single stage air conditioner and you have a call for cooling, you should have 24 volts present between pins **1** and **14** (Common and Y/Y2). If you do not have 24 volts there, check the harness, check the connection at the board. Remove the harness from the board and see if you have 24 volts at those same pins on the board. If you do, the problem is in the harness. If you don’t, the problem is in the board.

Keep in mind that pins 4, 5, 7, and 11 are not mentioned above. That is because these are not necessarily 24 volt

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jumper or switches are set on the CFM programming board: “A” Setting – no signal (0 VAC), “B” Setting – half wave signal (+), “C” Setting – half wave signal (-), and “D” Setting – Full wave signal (24 VAC).



As you can see from the diagram above, these can be 24 VAC or nothing or anywhere in between. None the less, these are the basic checks for the control board and inputs to the ECM motor module. It does take some time to check these. **Attached at the end of this post** is a sheet you can use to help record your voltages on the pins while you're laying on the floor in the blower compartment trying to check out the motor/module.

Hopefully, these checks will aid you in properly diagnosing ECM motor problems. Keep in mind, that nearly 40% of all ECM motors returned under warranty have nothing wrong with them, they were mis-diagnosed. These checks will help you make sure you have found the problem and not just “assumed” the motor was bad and replaced it.

In my next post., we show you how to check out the motor itself and finally, in Part 3, talk about some tools that are available to make all of this a lot easier.

### [ECM 16 pin Service Data Sheet](#)

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### About yorkcentraltechtalk

I have been in the HVAC industry most of my life. I worked 25 years for contractors on anything from residential to large commercial boilers and power burners. For the past 23+ years I had been employed by York International UPG Division ( a division of Johnson Controls) as a Technical support/Service Manager but I am now retired. One of my goals has always been to "educate" dealers and contractors. The reason for starting this blog was to share some knowledge, thoughts, ideas, etc with anyone who takes the time to read it. The contents of this blog are my own opinions, thoughts, experiences and should not be construed as those of Johnson Controls York UPG in any way. I hope you find this a help. I always welcome comments and suggestions for postings and will do my best to address any thoughts, questions, or topics you may want to hear about. Thanks for taking the time to read my postings! Mike Bishop

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## 36 Responses to ECM Motor Troubleshooting – Part 1

[David F. Branson](#) says:

August 15, 2013 at 1:03 am

If the motor turns hard, and the bearings are good, then one or more of the windings are shorted. Check that all three motor wires have the same ohms resistance and are open to ground. I had a motor that between the wires read 5.8, 5.8, 4.0 and the motor would jerk back and forth but would not run. I opened the motor and saw two dark spots where wires crossed, I separated the wires where they were shorted, and it ran fine after that. Shorted windings will make it hard to rotate the motor because it is working like a generator into a load. Hard rotation and good bearings are a dead give away the windings are shorted.

[Reply](#)

**Gonzalo** says:

July 14, 2015 at 1:16 pm

Help please. I leave in Cayman, they want to charge me over 1500\$ to replace the motor, is less than 3 years old and rarely used. I don't believe is the motor. Is rocking as you describe. Can you please clarify what do you mean by "between the wires read 5.8, 5.8, 4.0"? what cables are you talking about?

[Reply](#)



[yorkcentraltechtalk](#) says:

July 14, 2015 at 1:44 pm

most units with ecm motors hAVE A 5 YEAR parts warranty. You should check with your manufacturer to see if it is still under warranty! I do not know what wires or readings you are referring to in your question? I do not see that mentioned in the post. ("between the wires read 5.8, 5.8, 4.0") The 5 pin plug is your line voltage. The 16 pin plug has all the commands (24 volts) to the motor

**B connelly** says:

December 9, 2013 at 1:15 pm

That is partially correct. the resistance that is felt could be due to a problem in the board. If one of the mosfats is failed closed it completes the circuit and resistance is felt. with power applied the motor will rock or not move at all. don't be quick in

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**yorcentraltechtalk** says:

December 9, 2013 at 2:30 pm

if you read part 3 of my posts on ECM, we recommend the use of the TECMATE PRO to determine if the motor/module is bad.

Thanks for your input on this

[Reply](#)

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**dsomerv** says:

December 25, 2013 at 1:49 pm

In the text I read:

” If there is no jumper between pin positions 4 & 5, the motor is set up to operate on 220 volts”

further down I read:

“Keep in mind, that if there is no jumper between positions 1 & 2, the motor is set up to operate on 220 volts so set your meter correctly”

I’m confused ... and how to distinguish pin 1 from pin 5 ..

thanks, Dan S.

[Reply](#)



**yorcentraltechtalk** says:

December 26, 2013 at 7:23 am

Thanks for catching the error . It has been corrected. The correct positions are 1 & 2 for the jumper.

[Reply](#)

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**JOE** says:

March 5, 2015 at 4:31 pm

WHAT PINS SHOULD HAVE 24 VOLTS ON FAN ONLY

[Reply](#)



**yorcentraltechtalk** says:

March 6, 2015 at 8:19 am

pin 15 is G pins 1,3,or 8 are common. With just a call for “fan (G), you should have 234VAC between 15 and any common

[Reply](#)

**RICHARD MCMURRAY** says:

January 7, 2017 at 7:06 am

24Vac or 224Vac?

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Where are you testing. If you read the whole post, the motor/module has dual voltages to it.

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**Frank says:**

April 21, 2015 at 7:49 am

Big fingers or little keys. “24 volts” between 15 and common.

[Reply](#)



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**[yorkcentraltechtalk](#) says:**

April 21, 2015 at 8:01 am

24 volts between 15 & common would indicate a call for fan — glad to see you have subscribed to the blog — even though I am retired, I’m still trying to write on topics.

[Reply](#)

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**Roberto alonzo says:**

April 25, 2015 at 7:38 pm

Ecm motor wit 4 pin how to troubleshooting

[Reply](#)



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**[yorkcentraltechtalk](#) says:**

April 25, 2015 at 7:56 pm

the 4 pin ECM was made by A.O.SMITH. A.O.Smith was bought out by Regal Beloit. When they bought them out, they stopped making that motor. You could check their web site for support. York did make an analyzer that had an adapter to work on the 4-pin motor. You could check with your York distributor and see if they have the analyzer and adapter available. that analyzer will work on Any ECM motor from any manufacturer.

[Reply](#)

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**Pete Singh says:**

June 14, 2015 at 12:35 pm

Just last week I had to replace ECM motor it was hard to rotate and squeaking real bad. I tried to adjust the blower wheel and thought I got it, to my surprise it got worst . I took out and went York dealer( US Air) . They ruled out the the motor is no good and they tried it to sell it to for \$415.00. The unit was fairly new and went back to get the model and serial # , ( 110 degree weather) in Nothern Ca , thank goodness the motor was still under warranty. I made my customer very happy and I being very honest . The customer had no idea the motor was under warranty . Being honest the word of mouth became my business card.

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**[yorkcentraltechtalk](#) says:**

June 15, 2015 at 8:56 am

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**Jon says:**

November 21, 2015 at 12:46 am

Our Trane HVAC system has not been heating for the past couple of days. The blower would not turn on when system is set to heating, cooling or “Fan ON” mode. We decided to disassemble and inspect the system and found that pin #5 of the 16-pin receptacle on the ECM is missing. In fact the pin broke off and is stuck on the corresponding connector plug of the wiring harness. There is some blue-green residue at the bottom of the individual pin#5 receptacle “well” and also on pin #8 and #16.

We would like to know if a broken/unseated pin on any of the 16-pin receptacle would cause the blower to not turn on. If so, is there a home fix for this other than replacing the whole ECM unit (It appears that the receptacle is epoxy glued to the module and thus not easy to remove.) Thank you.

Jon

[Reply](#)



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**yorkcentraltechtalk says:**

November 21, 2015 at 7:22 am

broken pins will cause the motor to not operate. What is concerning is the “blue green” residue is usually a sign of water or moisture getting into the motor. The wiring harness should be facing DOWN with a “drip loop” hanging down to keep any water/moisture out of the motor. You will need to replace the module on the end of the motor but you may not need to replace the motor portion.

When you do replace, make sure you find the source of moisture and correct and make sure the connections are facing down with a drtp loop in the wiring harnesses

[Reply](#)

**Jon says:**

November 21, 2015 at 2:19 pm

Thanks for your response. Unfortunately the wiring harness plug faces horizontally when connected to the ECM due to the orientation of the 16-pin receptacle but there is a drip loop still. Perhaps I could silicon around the connection seam between the plug and the ECM receptacle to keep the moisture out?

I do see a water/moisture drainage pipe leading out from the returns. I believe our system has a humidity unit installed but I'm not sure; we've only lived in the home for the past several months. Today in Illinois we just had 1 feet of snow so the timing of it all couldn't have better. 😊

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**Art Houston says:**

January 9, 2016 at 4:11 pm

Many of the responses posted here are from do it yourselfers, and not technicians. Unless a non professional has other technical experiences relating to electricity, this work should be left to a professional who has the talent, knowledge, and experience needed to safely work on this system.

[Reply](#)



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**yorkcentraltechtalk says:**

January 10, 2016 at 2:35 pm

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**[dsomerv](#)** says:

January 10, 2016 at 4:05 pm

In an ideal world, the thrust of your advice is correct: one would prefer to contact the dealer , distributor, or manufacturer for professional attention.

One reason that do-it-themselfers dig in to solve problems is of necessity: dealers often have sketchy knowledge or just aren't available; distributors only want to talk to dealers; and manufacturers want nothing to do with the problems of end-users or guiding them to competent technicians.

[Reply](#)



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**[yorkcentraltechtalk](#)** says:

January 11, 2016 at 8:14 am

Most manufacturers have a “Dealer Locator” on their web site which is usually reserved for registered/certified dealers. Also, N.A.T.E. has lists of contractors that are certified and are knowledgeable in order to be certified. The end user should always try to go back to his original installer for service.

[Reply](#)

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**Jovani Rioja** says:

June 22, 2016 at 9:23 pm

My Ecm motor turns on at a delay. Runs for 5 mins and then shuts off. Then turns on and again for 5 mins. My tech said we need to change the motor and module. Is this normal? Or is the motor at the end of its life? As well there is a leak in the evaporater and my tech said he won't fix the leak until the he fixed the blower. Is this true? Or can he just fix the leak and let the motor run for 5 mins on and off? Please let me know thanks!

[Reply](#)



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**[yorkcentraltechtalk](#)** says:

June 23, 2016 at 5:44 pm

As far as the leak, he needs a functioning motor to properly charge the unit. So, yes, the blower motor issue needs to be resolved first.

Is your ECM motor a X-13 motor or a true ECM motor? A true ECM has a separate motor and a separate module and can be replaced independently of each other. An X-13 is a one piece assembly.

[Reply](#)

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**Jerry henricksen** says:

December 12, 2016 at 8:31 am

Thanks for the great information. I have been troubleshooting my intermittent problem for about a month. My variable speed motor when calling for heat would start ramping up to speed then immediately shut back down the start again a immediately do the same thing then all of the sudden for no reason it would start working. I took the ECM module out and looked for bad connections and also the control board in my HVAC unit and all looked great. That's when I googled and found your site. I started taking voltage reading on my ECM connector and instead of having 24 volts I had 17 volts on my transformer on the

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**yorcentraltechtalk** says:

December 12, 2016 at 8:34 am

Glad the post helped solve the problem.

[Reply](#)

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**Peter** says:

January 16, 2017 at 2:51 pm

Excellent article, thank you. Do you happen to have a data sheet with required voltages for the 4 pin 3.0 ECM?

[Reply](#)



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**yorcentraltechtalk** says:

January 16, 2017 at 4:14 pm

See my posts on X13 motors

[Reply](#)

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**Peter** says:

January 17, 2017 at 2:53 pm

Thank you for the reply. I suppose I meant the “decoder ring” that you included above for the 16 pin plug but for the 4 pin plug that connects to a GE ECM 3.0 motor module (Regal Beloit).

[Reply](#)



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**yorcentraltechtalk** says:

January 17, 2017 at 3:16 pm

The 4 pin plug has inputs from the board. Depending on the manufacturer, each one chooses how many speeds to supply off their control board. All the low voltage hours are 24 vac and the motor can be either 110 or 220 vac.

[Reply](#)

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**Peter** says:

January 17, 2017 at 3:25 pm

Thanks. There is no jumper on the 5 pin high voltage plug therefore assume that it's 220 vac?

[Reply](#)



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**yorcentraltechtalk** says:

January 17, 2017 at 3:26 pm

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**Peter** says:

January 18, 2017 at 12:04 pm

When checking the high voltage input per your instructions above, 5&4 reads 253, 5&3 reads 125 and 4&3 reads 125. Both 5 and 4 (hot and neutral) have some possible blackening in the white plastic housing around those pins. There is no jumper between 1 & 2.

I'd be grateful for any further thoughts you may have. Thank you.

[Reply](#)



**yorkcentraltechtalk** says:

January 18, 2017 at 2:04 pm

See my post titled "X-13 motor troubleshooting". Hopefully that should help?

[Reply](#)

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