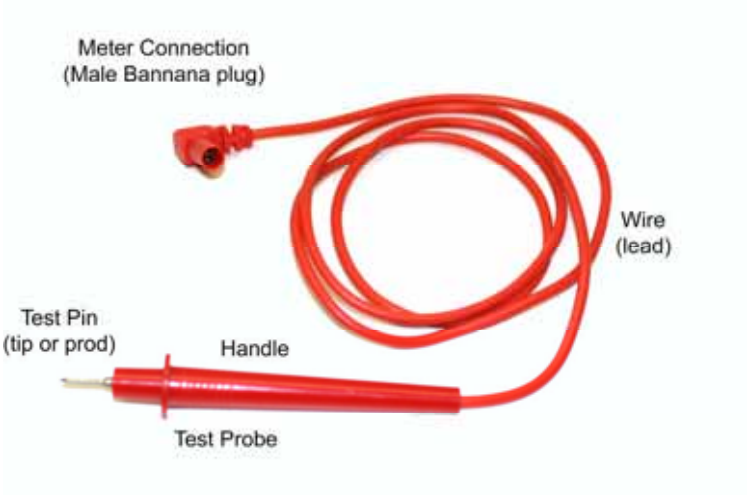
Meter Leads

Christopher Mohalley – GE ECM Master Motor Trainer

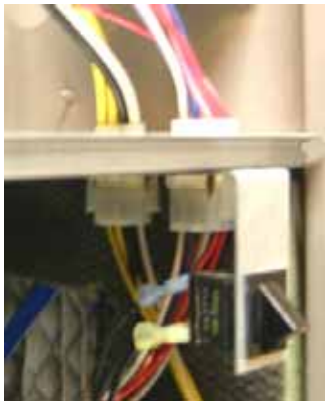
Typical meter leads (those that are supplied with Volt Ohm Milliampere meters) are commonly called test leads or test probes. This paper will specifically refer to the “test pin” as shown in the picture to the right. The rest of the assembly is typically universal throughout most suppliers including the meter connection, wire, and handle.



Other than the thermostat and high voltage main power connections, most of the wiring in residential HVAC equipment that is connected to the circuit boards, through the blower deck, and to the motors, use plugs and connectors.

Examples of some typical HVAC system connectors:

Circuit Boards **Through Panels and Decks** **Motors**



  Issued 3-22-007

In the field, these connectors are often called Molex plugs. However, “Molex” is a manufacturer of connectors and they are not the only one. In fact many of the connectors used in the HVAC industry are not “Molex”. Tyco industries, who owns Amp (a brand name of Tyco Electronics) is the largest manufacturer of these types of connectors. Connector is a good generic name for these components since; after all that is what they do; connect two or more wires together. After looking over many HVAC manufacturers’ schematics I have found them referred to as “connector”, “plug”, “jack”, and “jack/plug”, unfortunately with no consistency. For the purpose of this paper, we use the generic term connector in addition to the terms “pin” instead of “male” and “socket” instead of “female”.

The goal is to accurately check the voltage on the individual pin’s and sockets for the purpose of troubleshooting the system. The challenge is getting the large test pin found on most meter leads into these connections enough to get these readings, without causing damage to the connection

The “test pins” on typical meter leads are very large in comparison to the pins and sockets in the connectors that most HVAC manufacturers use.

To make matters worse, many of our test pins have been modified by the accidental welding practice (arcing) caused by trying to check a high voltage source too close to a ground source such as a tight 2 x 4 gang box, or a motor lead terminal on a circuit board right next to the neutral terminal. These modified (gangly, sharp, burnt and distorted) test pins are even more difficult to use in the delicate connectors.

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Smaller test pins are available that can make taking these readings easier, faster and reduce the potential for damage and future call backs.

Typical meter lead with a large test pin

Meter lead with a small test pin

Whenever possible, voltage readings should be taken with the connector separated and the test pin on the pin or socket of the connector. **Power (voltage) to the system should always be off when disconnecting or re-connecting any connector to prevent arcing.** Notice how the smaller test lead gets the reading without the potential for damage as shown with the larger test pin.

Sockets that are spread apart do not make a proper connection and could lead to no connection or arcing due to a loose connection.

Pins that are bent may not make a precise connection, which could distort the opposing terminal or even push it out of the connector, again creating the possibility of no connection or arcing on a loose connection.

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Sometimes it is necessary to take voltage readings with the connector together or connected to a circuit board. Where the wires enter a connector there is typically little room for a meter lead at all. Getting a reading here typically involves poking through the insulation (this is never a good practice as the insulation is now compromised), or pushing and shoving the lead all they way down to the securing strap or terminal to get a reading. If the securing strap is damaged, the pin or socket may get pushed out of the connector or make a loose connection that can cause arcing. Both of these potential problems are likely to cause a service call (call back) in the future.

As you can see from the following pictures, the difference in test pin size has a huge effect on potential damage, proper readings, and ease of use.

The connectors (shown below) used on GE ECM Premium Indoor Blower Motors Models 2.0/2.3 & 2.5 should always be removed from the motor to check for voltage. The voltage check on the sockets of these connectors is fairly easy with the larger test pin and a gentile touch. However, there is still the potential to spread the socket open, causing a lose fit when reconnected that could lead to arcing or no connection at all.

5-pin high voltage connector

16-pin low voltage communication connector

Connectors serve many purposes. They make removing parts and components for maintenance and repair easier. Removing a blower housing, for example, used to require a lot of disconnecting and reconnecting of individual wires. Now it's typically a couple of plugs. Hot surface igniters have used plugs for a long time making them easy to remove and replace without extensive wiring.

The only downside to these connectors is a wire or circuit that now has multiple break points. However, if undamaged from voltage checks by our test pins, and care taken when disconnecting and reconnecting, they should last the life of the system without fail.

Replacing terminals (pins and sockets) in plug/connectors is typically not an option in the field and wiring harnesses are very expensive. So we must be careful not to damage them when making voltage checks.

Service calls are all about speed, quality and getting it right the first time. The smaller meter leads described in this paper will help with the accuracy of your readings, and prevent the possibility of future repairs (call backs).

The meter leads described in this paper can be purchased from most meter manufacturers and supply houses. The meter leads pictured here were generously supplied by **Test Products International (TPI).**

For ordering information on TPI products please call (800)-368-5719 or visit their website at http://www.tpi-thevalueleader.com.

Back Probe (1ea. Red & Black)

The small test pins featured in this paper are called "Back Probes" and are only available in a banana plug (quick connect) end. They are rated for 1000volts and 10amps.
P/N – AO57

See the next page if your meter leads do not have this style end for connectors and/or meter leads options.

For test leads with threaded test pins:

Banana adaptor to screw tip (1ea. Red & Black)

This connector will convert the threaded end of a meter lead to a banana plug (quick connect).
P/N - AO52

New test leads with threaded test pins:

Test lead w/screw tip (1ea. Red & Black)

This set has a standard plug to fit most meters with a threaded end for screw on connectors and probes.
P/N – AO80

New test leads with banana plug end:

Test lead w/ banana plug (quick connect) end

These leads have a standard plug to fit most meters with a banana plug (quick connect) end for connectors or probes.
Test lead w/banana plug (Red)
P/N – 123501R/5FT
Test lead w/banana plug (Black)
P/N – 123501B/5FT

The information provided in this paper on TPI products is current as of the date of its release. Product names, part numbers, configurations and availability may have changed since then.

  Issued 3-22-007

This material has been created and distributed for the purpose of education and to encourage best practices of the HVAC industry. The integrity of the industry we share is the responsibility of every one working in it including its educators to uphold the faith of the consumers who put their trust in us as professionals.

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