

TROUBLESHOOTING CAN SYSTEMS

This document is intended to be used as a guideline to troubleshoot CAN systems.

Consult the application drawing to find out how the system is built and connected. Consult the cable drawings to find out at which pins to measure and where fuses, relays and CAN terminators are located. Use a multimeter to measure voltage and resistance.

- The system must be powered and switched on to measure voltages
- The system must be switched off completely to measure CAN resistance

1 MEASURE ECU POWER AND GROUND

ECU power or Logic power is powering the nodes and sensors.

Consult the cable drawing for the pinout. Battery voltage (12 to 14 Volts) should be measured. If a road switch is present, this should be set to GPS operation mode.

If ECU power is not there:

- Check if the issue is in the power or the ground
- Check the ECU power fuses
- Check the ECU power relay, near the battery

If implement ready cabling is installed, ECU power has two fuses:

- the first near the battery, protecting the wiring to the IBBC, along with the wiring connected to the IBBC (implement)
- the second near the IBBC, protecting the wiring and nodes on the tractor

Implement cabling has its own additional fuses.

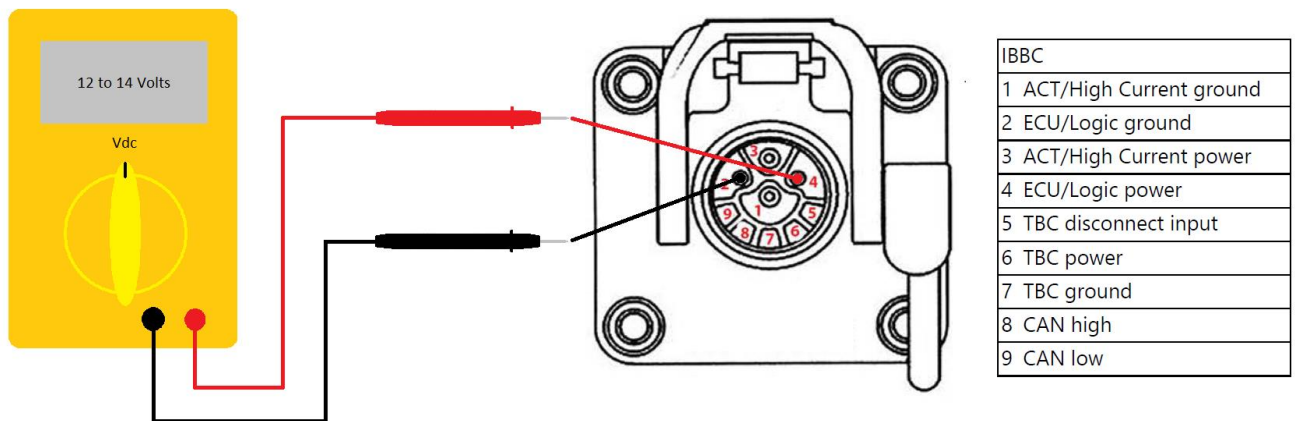


Figure 1 Measuring ECU power at the IBBC

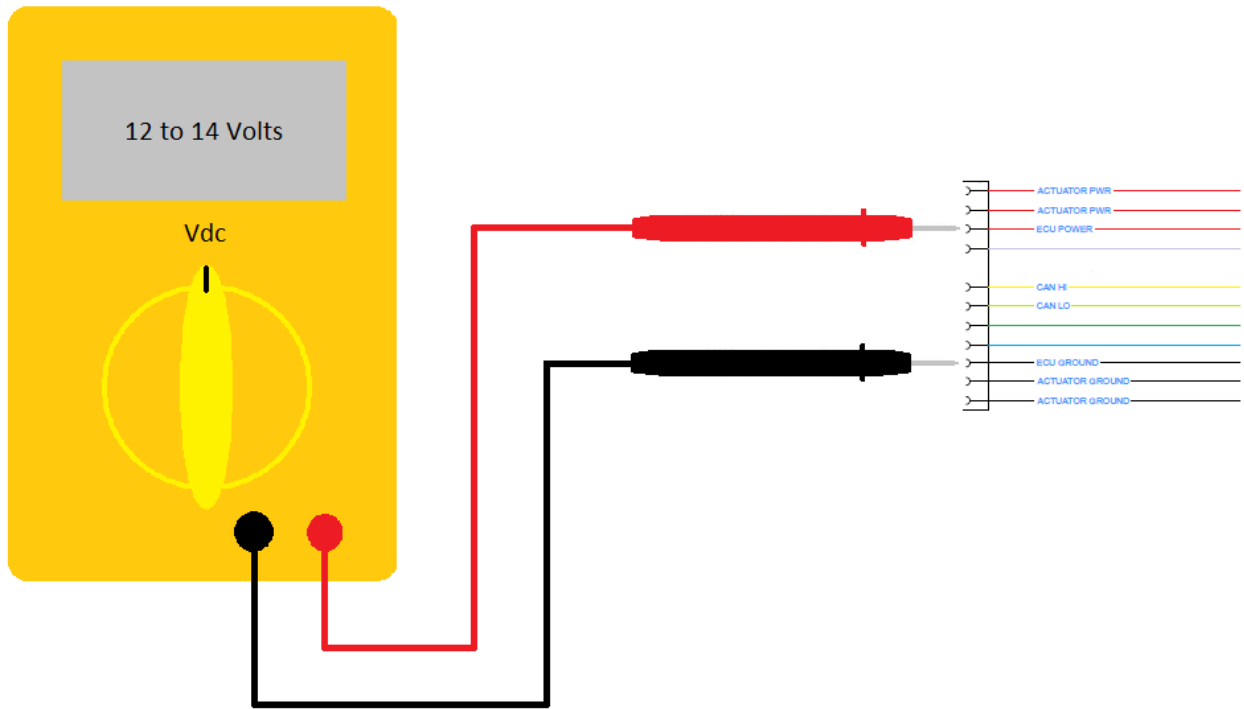


Figure 2 Measuring ECU power at a connector

2 MEASURE ACT POWER AND GROUND

ACT power or High Current power is powering actuators like valves and solenoids. At some nodes the ACT power is required to have the node participating on the CAN network (e.g. the HDU and IDU nodes).

Consult the cable drawing for the pinout. Battery voltage (12 to 14 Volts) should be measured. Some connectors are wired with more than one pair of ACT power and ACT ground wires. If a road switch is present, this should be set to GPS operation mode.

If ACT power is not present:

- Check if the issue is in the power or the ground
- Check the ACT power fuses
- Check the ACT power relay, near the battery

If implement ready cabling is installed, ACT power has two fuses:

- the first near the battery, protecting the wiring to the IBBC, along with the wiring connected to the IBBC (implement)
- the second near the IBBC, protecting the wiring and nodes on the tractor

Implement cabling has its own additional fuses.

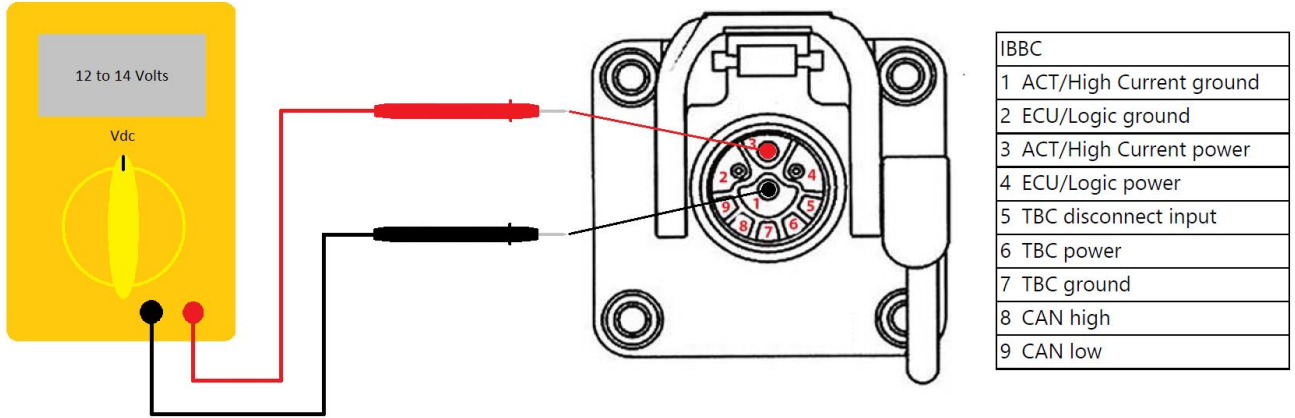


Figure 3 Measuring ACT power at the IBBC

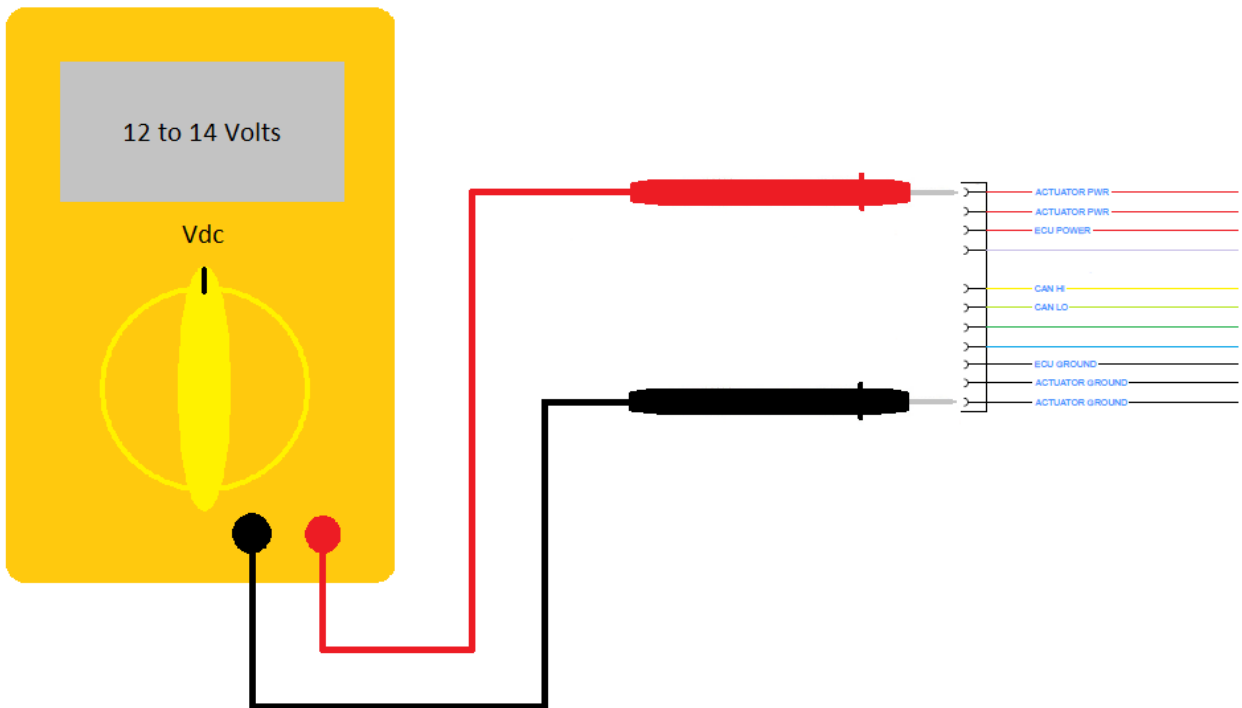


Figure 4 Measuring ACT power at a connector. Be aware to also measure the second pair of ACT power wires.

3 CHECK FOR DISRUPTIONS

Consult the application drawing to locate the harnesses and connectors.

CAN issues can be caused by disrupted connection in the wiring.

- Check for retracted pins or sockets in the connectors
- Check the pins and sockets for corrosion inside the connectors
- Check the harnesses for damage
 - o When damage to a harness is found, check the wiring inside

4 CHECK FOR SHORT CIRCUIT

Consult the application drawing to locate the harnesses and connectors. The chassis of the vehicle is usually an electrical ground.

CAN issues can be caused by short circuit in the wiring.

- Check for water and corrosion inside connectors
- Check for loose wire strands inside connectors
- Check the harnesses for damage
 - o When damage to a harness is found, check the wiring inside
 - o Check if any wiring is scuffing or abrading to the chassis or any metal part of the vehicle

5 MEASURE CAN VOLTAGES

Measure CAN voltages at the connector of each node, starting at the most suspected node. Consult the cable drawings for the pinout of the connectors.

Typical wire colors:

- Black Ground
- Yellow CAN High
- Green CAN Low

CAN voltage should be measured between:

- CAN High and Ground
 - o Depending on the bus load between 2.6 Volts and 3.6 Volts
- CAN Low and Ground
 - o Depending on the bus load between 2.4 Volts and 1.4 Volts

The sum of the values 'CAN High to Ground' and 'CAN Low to Ground', should be around 5 Volts.

If CAN Voltages are not correct.

- Check if the ground wiring is okay
- Exchange the IBBC
- Disconnect or exchange each node one at a time

Measure again after each change and check if the voltages change, to determine which part fails.

If no change to the correct CAN voltages occurs, it is time to exchange cables one at a time. Measure again after each change and check if the voltages change, to determine which cable fails.

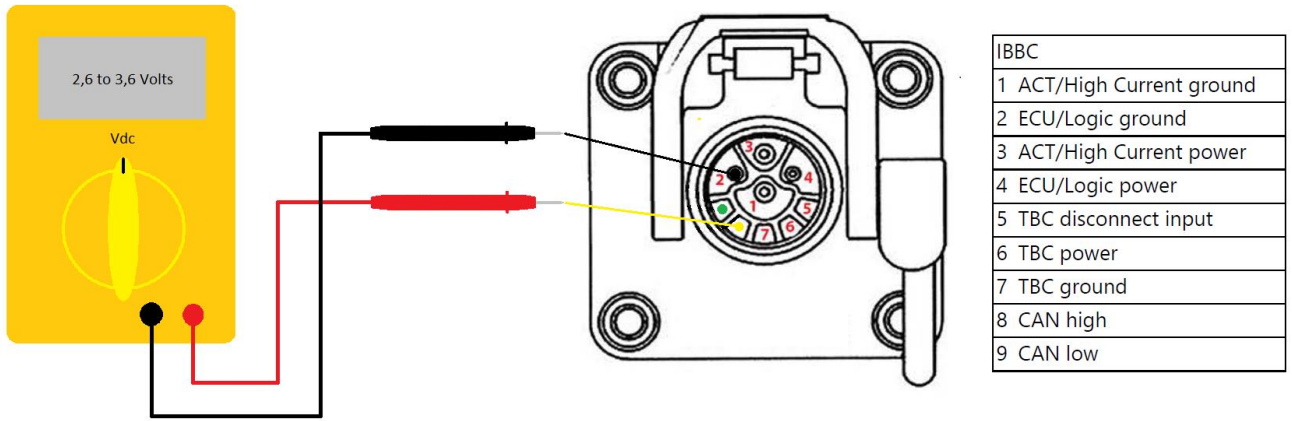


Figure 5 Measuring CAN High voltage at the IBBC

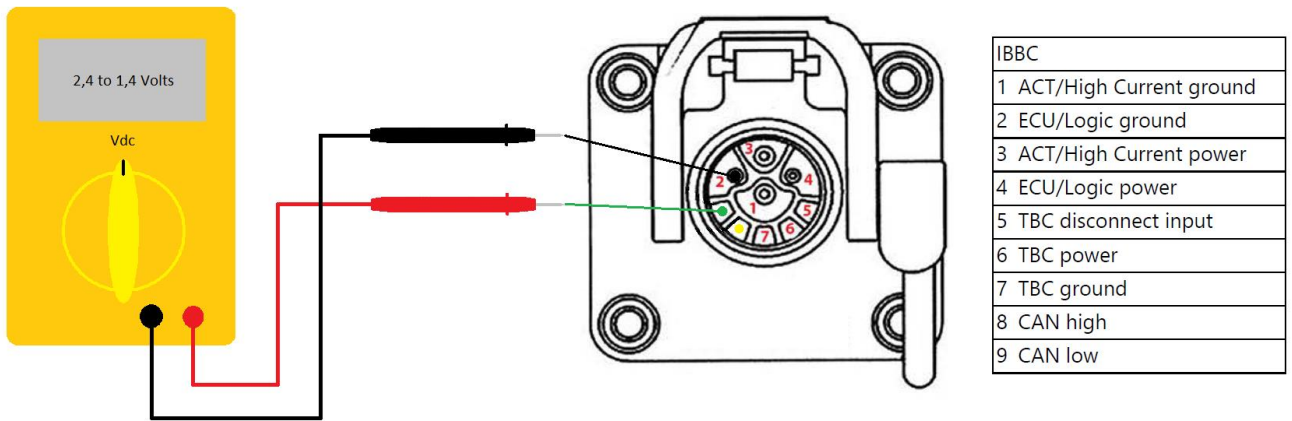


Figure 6 Measuring CAN Low voltage at the IBBC

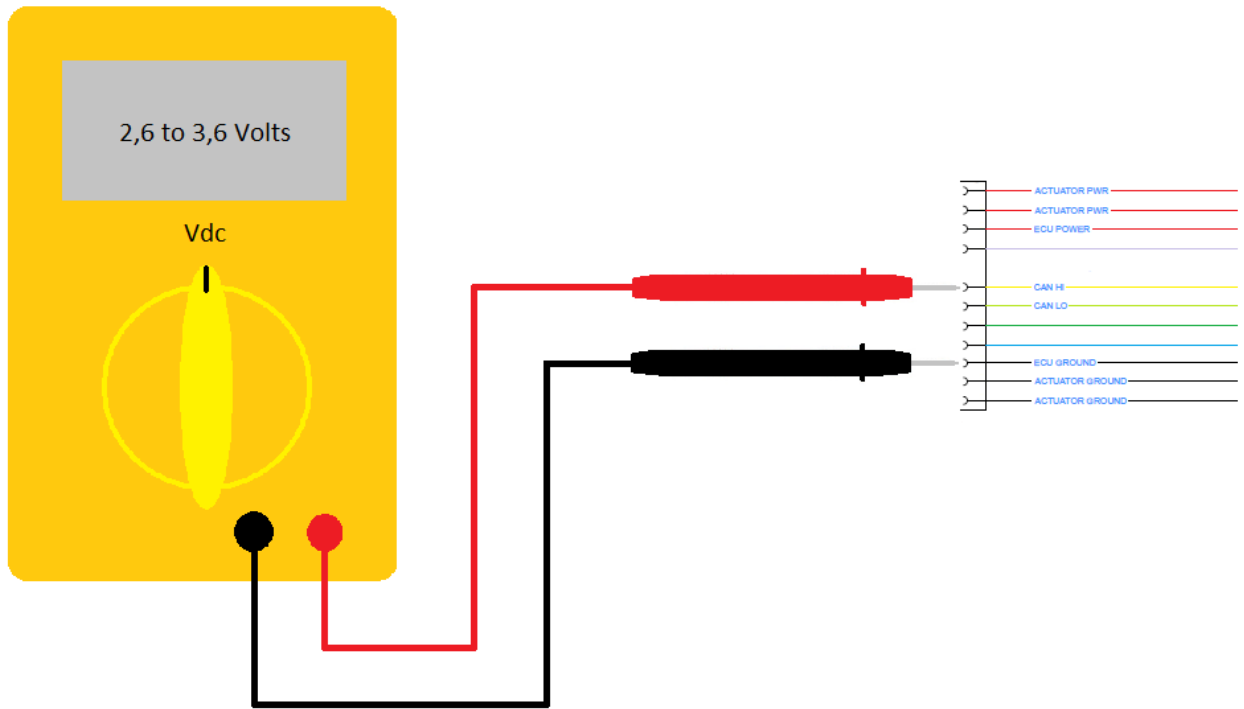


Figure 7 Measuring CAN High voltage at a connector

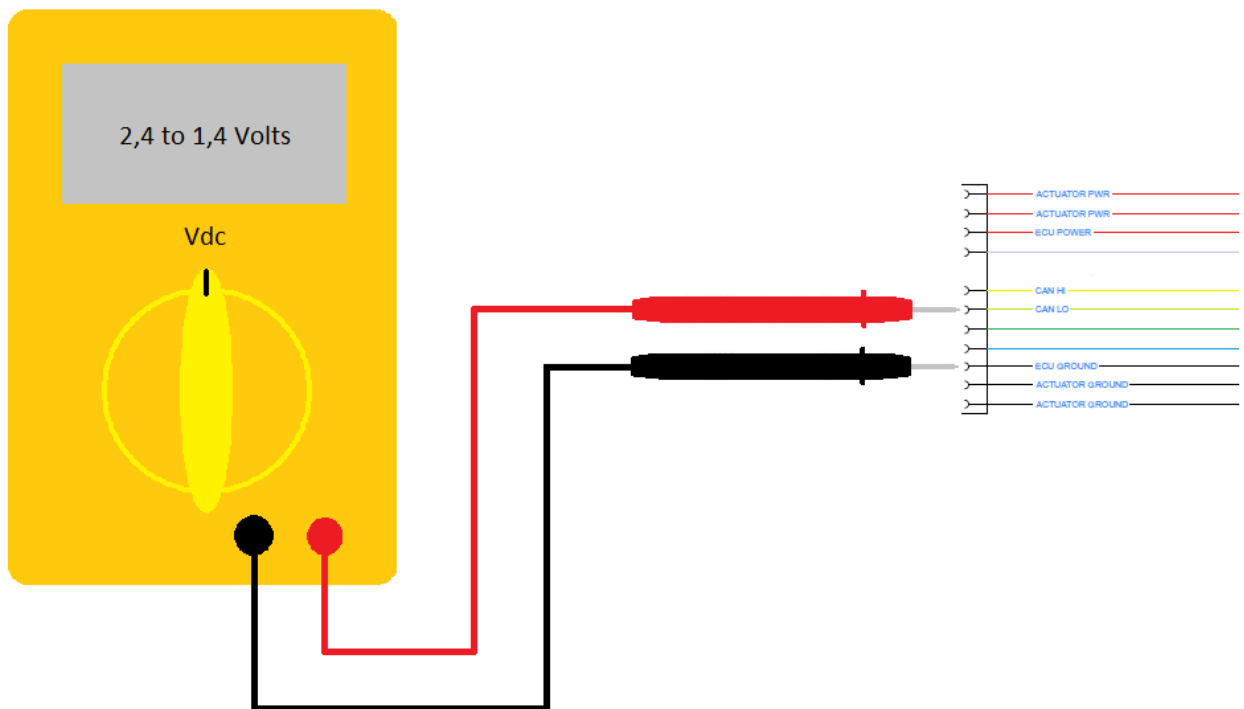


Figure 8 Measuring CAN Low voltage at a connector

6 MEASURE CAN RESISTANCE

This can only be performed with all nodes switched off. Some nodes may have a delayed switch off, e.g. the RS1. Be sure that all nodes are switched off and asleep before measuring. Measure CAN resistance at the connector of each node, starting at the most suspected node. Consult the cable drawings for the pinout of each connector.

Typical wire colors:

- Yellow CAN High
- Green CAN Low

The CAN resistance is depending on the type of termination.

- A passive terminator should read around 120 Ω
- A system with 2 passive terminators should read around 60 Ω
- An active terminator should read a high value (infinite resistance, k Ω or m Ω)
- A controller or node should read a high value (infinite resistance, k Ω or m Ω)
- Cables or harnesses without any controller, field computer or terminator should read infinite value

When Raven Europe implement ready cabling is installed the typical resistance is around 120 Ω .

A low value (zero or close to zero) indicates a short circuit.

If CAN resistance is not correct, disconnect the IBBC and each node one at a time. Measure again after each change and check if the resistance changes, to determine which part fails.

If no change to the correct CAN resistance occurs, it is time to exchange cables one at a time. Measure again after each change and check if the resistance changes, to determine which cable fails.

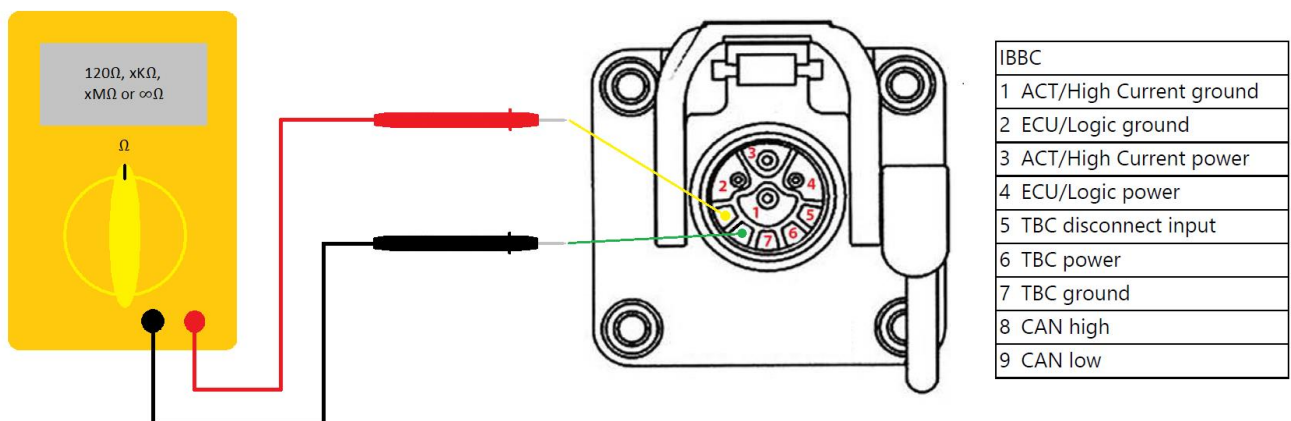


Figure 9 Measuring CAN resistance at the IBBC

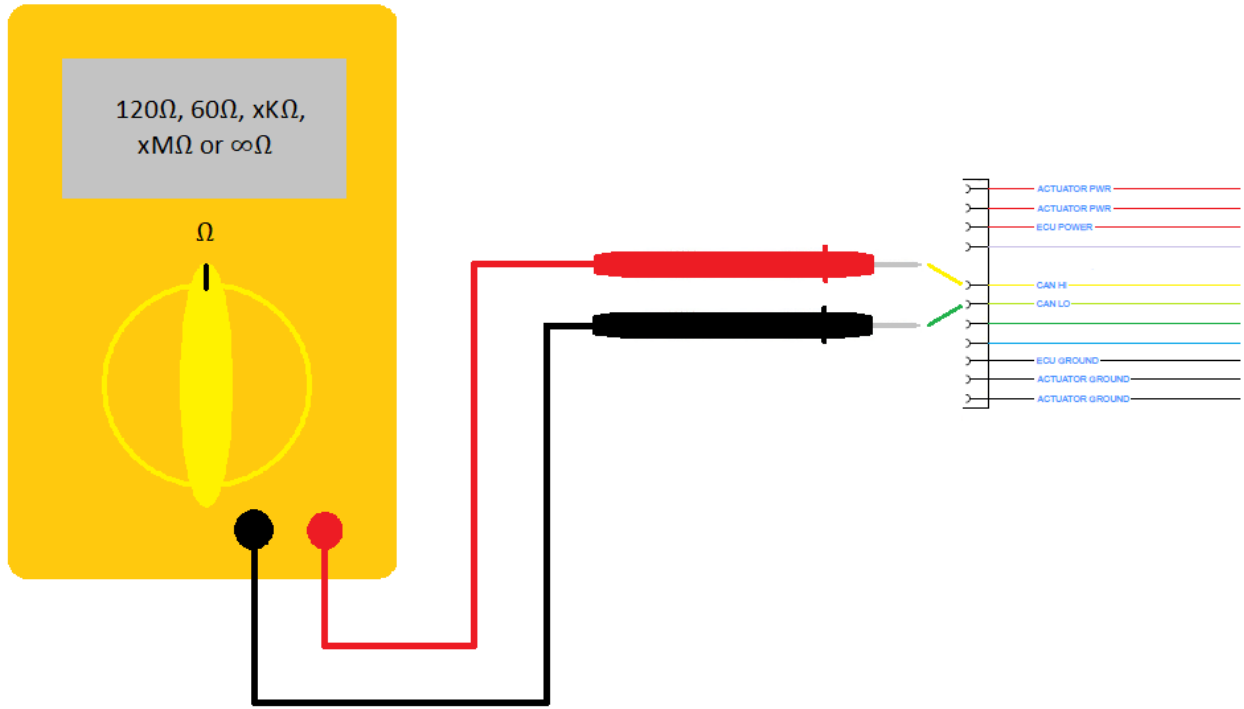


Figure 10 Measuring CAN resistance at a connector