TS 1033683 : Checking and Testing J1939 and Diagnostic "Truck" CAN Networks

Training Solution 1033683: Checking and Testing J1939 and Truck CAN Networks

Applicable Vehicles:

Cascadia
New Cascadia vehicles have a different architecture, however similar concepts can be applied.

Purpose of Solution:

This supplemental troubleshooting guide is to provide additional information to the technical literature guides, and to offer some best practice guidelines to assist in diagnosing J1939 and CAN communication systems.

Solution:

J1939-CAN and **H1939** are the same and both operate at a baud rate of 500k
- These communication busses are specifically for use by factory supplied modules
J1939 and **J1939-OPEN** are the same and operate at a baud rate of 250k
- These CAN busses are intended for third party module connection and interface

Checking Resistance

- To test resistance on any of the CAN circuits the truck should be in a state of **ignition OFF and batteries disconnected.**
- For termination resistor locations refer to SS 3920 J1939 Terminating Resistor Locations - Cascadia

Diagnostic "Truck" CAN network

Test the resistance between pins **H & J** at the diagnostic connector.

J1939/H1939 500k baud network

Test the resistance between pins **C & D** at the diagnostic connector.
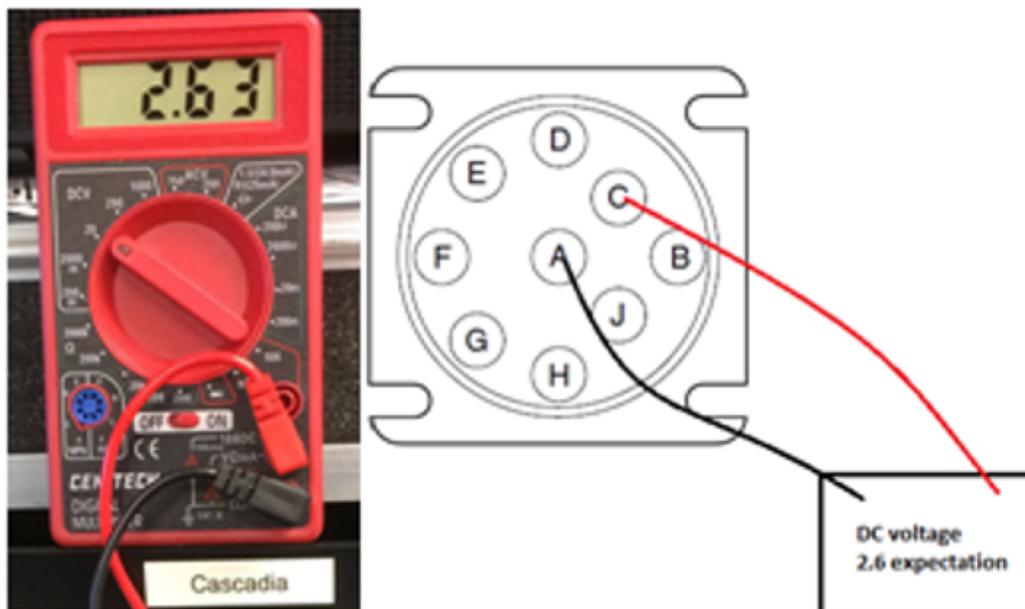
Resistance Values for both networks should be 60ohms +/- 3ohms

# Checking Voltages J1939/H1939

- To test the voltage the truck should be in the state of **ignition ON, engine OFF, and batteries connected.**

NOTE: Battery condition is important and should be in the range of 12.6V and 12.4V
1. Test the voltage at the diagnostic connector between pins **A & C**

DC voltage
2.6 expectation

2. Test the voltage at the diagnostic connector between pins **A & D**
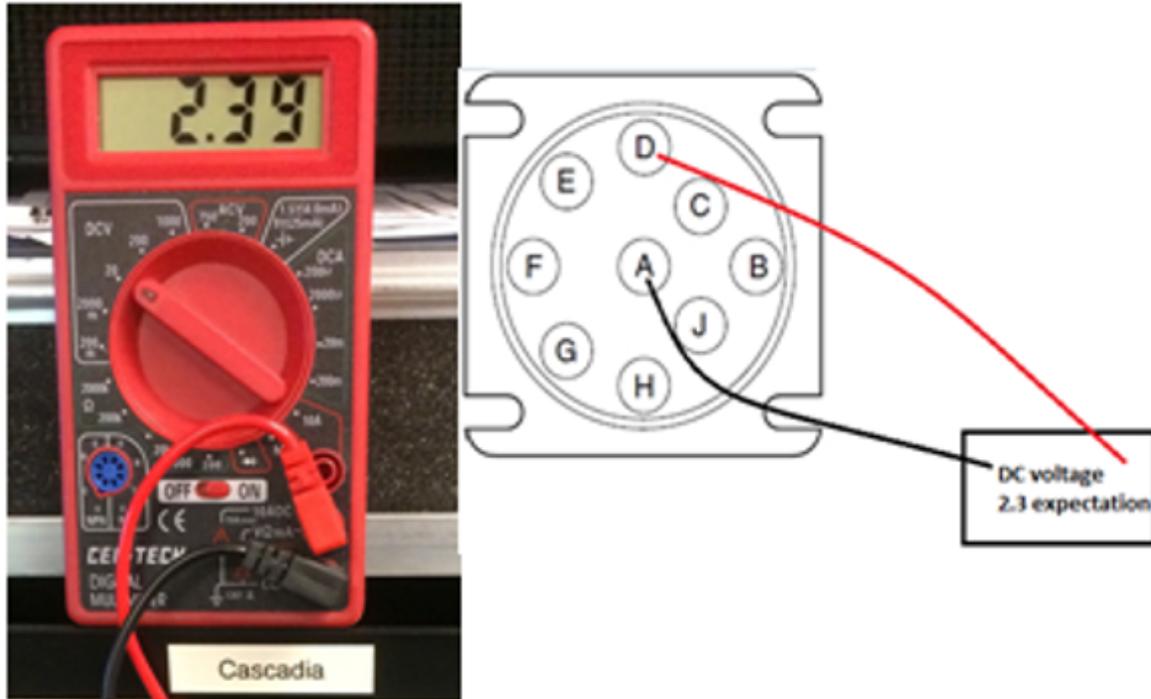
Voltage readings between pins **A & C** should be 2.6V +/- 0.1V

Voltage readings between pins **A & D** should be 2.3V +/- 0.1V

Voltage Test Result Meaning

- If there is no voltage - There is likely a short in the J1939/H1939 backbone or one of the modules itself.
- If the voltage is fluctuating - There is likely a polarity problem at one of the modules or one of the inline harness connectors on the CAN buss.
  If the voltage is out of range *(ie. 1.9V low side, or 2.8 high side)* - There is likely a module on the network causing the issue
  - Start to unplug modules one at a time, starting with the ABS module, while monitoring the voltage reading
  - Once the voltage comes back into spec, the last module disconnected will need to be checked for proper voltage, ground and J1939/H1939 voltage.

Checking Continuity and Bandwidth of J1939/H1939

- Continuity and Bandwidth tests should be conducted with all modules and 120ohm terminating resistors removed
- Install a jumper wire across both legs of the network similar to the diagram below.

All controllers removed

**J1939 120 ohm
resistors removed**

Jumper across both legs of the J1939
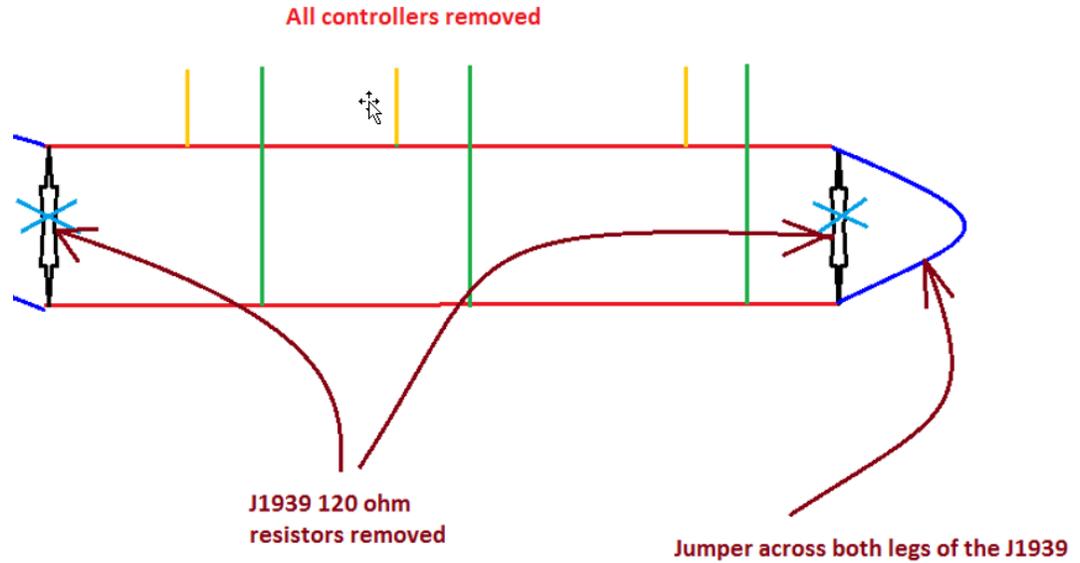
Continuity Test

If both resistance and voltage tests pass - check the continuity of the datalink using a basic continuity test.
Similar to the diagram below:

All controllers removed

OHM

**J1939 120 ohm
resistors removed**
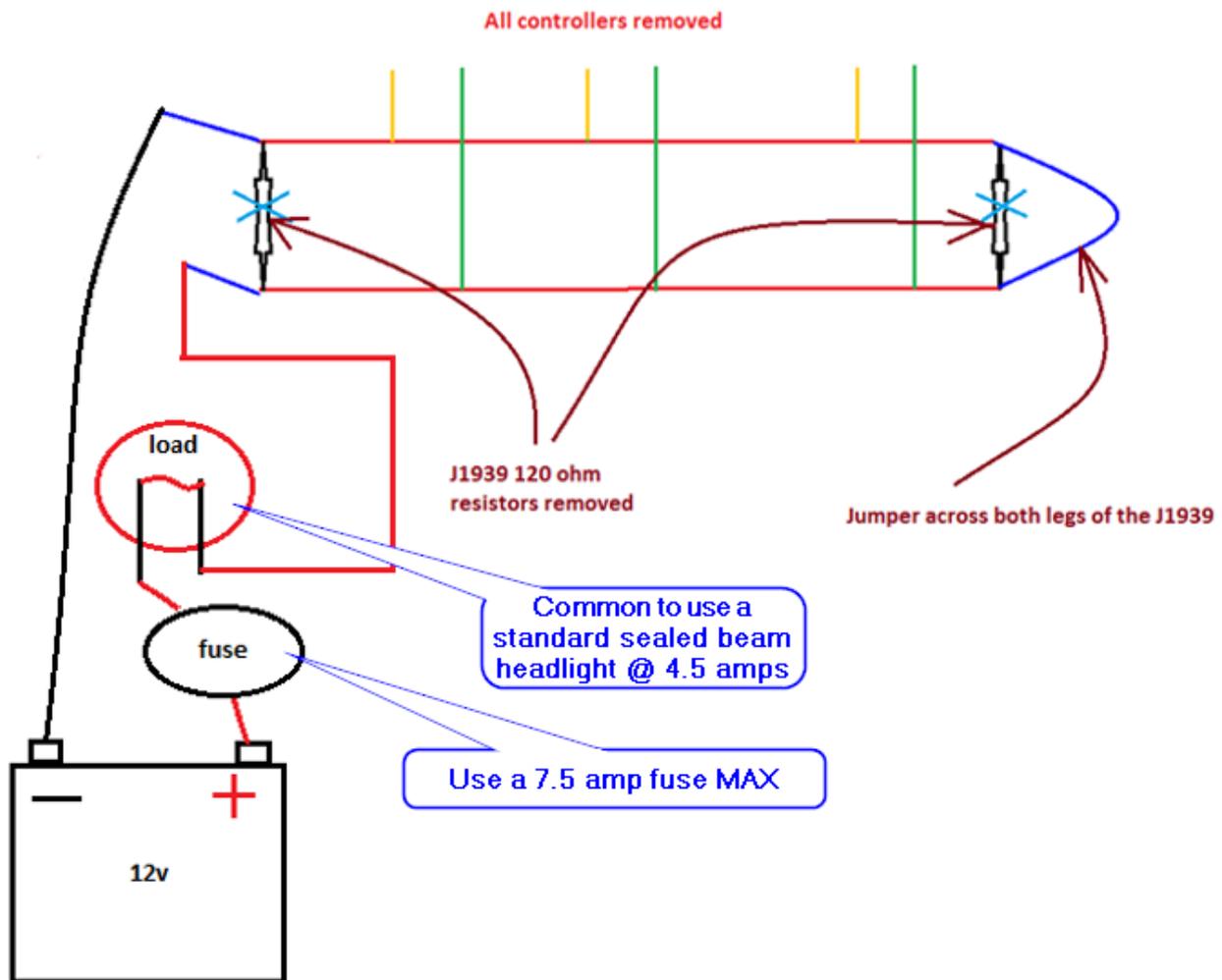
Jumper across both legs of the J1939
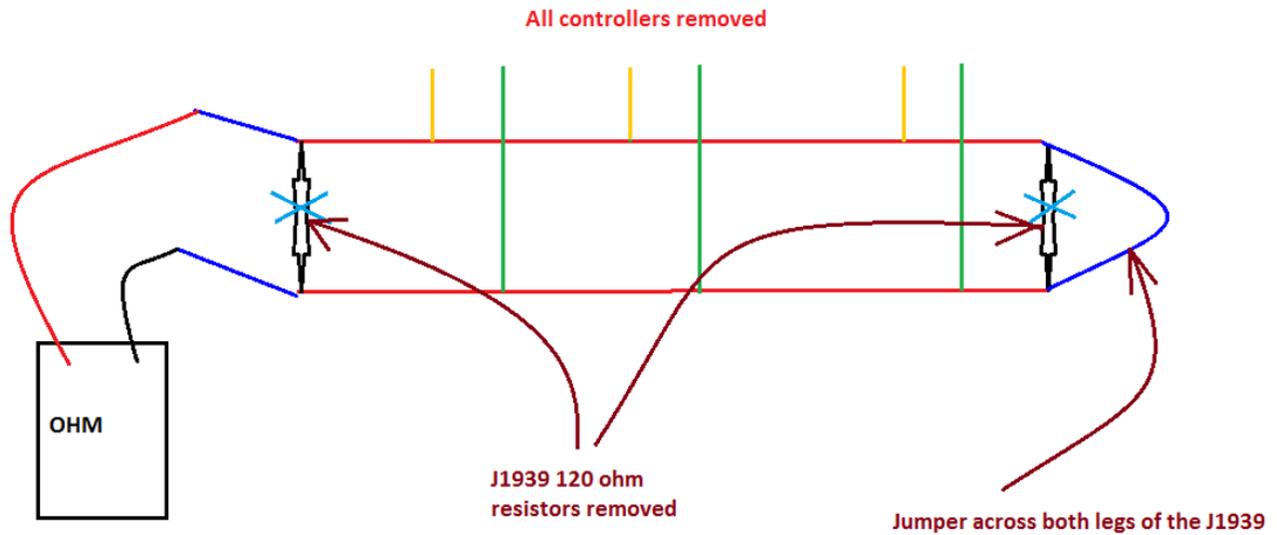
Bandwidth Test

If the datalink shows good continuity - perform a load test to check the network bandwidth
- Common to use a Sealed Beam Headlight under a 4.5amp load
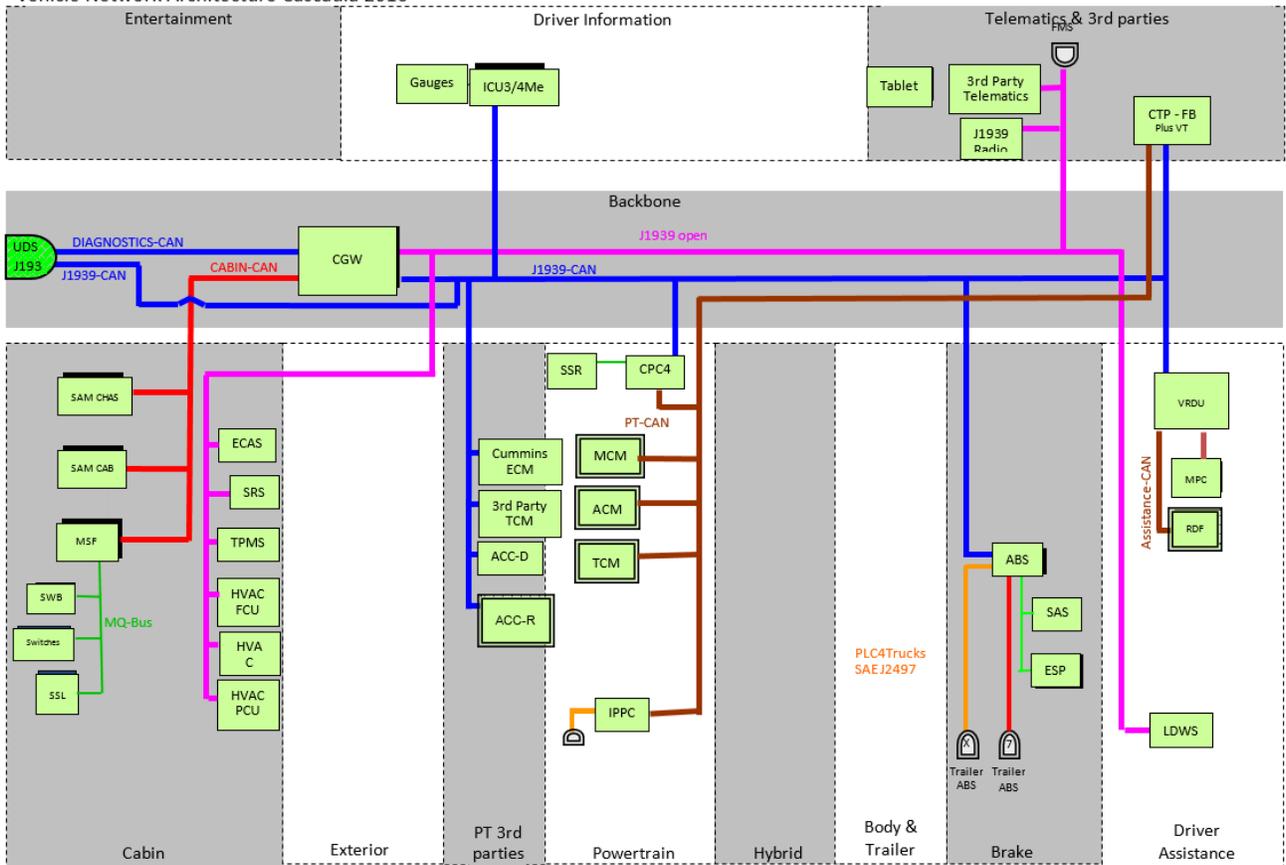
- Use at maximum a 7.5amp fuse

Additional Info and Resources:

Network Architectures

Vehicle Network Architecture Cascadia 2016

Entertainment	Driver Information	Telematics & 3rd parties

Gauges ICU3/4Me

Tablet 3rd Party Telematics CTP - FB Plus VT

J1939 Radio

Backbone

UDS J193

DIAGNOSTICS-CAN

J1939-CAN CABIN-CAN CGW

J1939 open

J1939-CAN

SSR CPC4

PT-CAN

Cummins ECM MCM

3rd Party TCM ACM

ACC-D TCM

ACC-R

SAM CHAS

SAM CAB ECAS

MSF SRS

SWB TPMS

Switches HVAC FCU MQ-Bus

SSL HVA C

HVAC PCU

IPPC

VRDU

MPC

Assistance-CAN

RDF

ABS

SAS

ESP

PLC4Trucks SAE J2497

Trailer ABS Trailer ABS

LDWS

Cabin	Exterior	PT 3rd parties	Powertrain	Hybrid	Body & Trailer	Brake	Driver Assistance

Cascadia CAN Layout

J1939 250k, PT CAN and Cabin CAN Layout

(including other platforms)

SS 469463 - Electronic Architecture Drawings - OBD16 and Newer
SS 1033147 ALL MY2017/MY2018 OBD16-GHG17 EE Wiring Architecture
SS 1033031 New Cascadia (38N) Wiring Architecture

List of Possible Modules

(may not be comprehensive)
1. Predictive Cruise (Mod 149)
2. QualComm (Mod 786)
3. Virtual Technician (Mod 813)
4. SmartTire (Mod 489)
5. Rear HVAC (Mod 200)
6. OnGuard, Detroit Assurance (Mod 736)
7. Radio (Mod 221)
8. Lane Departure (Mod 73B)
9. ABS (Mod 49A)
10. Front HVAC (Mod 146)

Wire Colors & Pin Outs

Green Data Link Connector	**Black Data Link Connector (optional)**
J1939-CAN is the 500k baud rate. Wire colors:	J1939 open is the old 250k baud rate. Wire colors:
H1939 High (+) – White with Yellow stripe	J1939 High (+) - Yellow
H1939 Low (-) – White with Green stripe	J1939 Low (-) - Green

H1939-CAN (J1939-Open or 500k)

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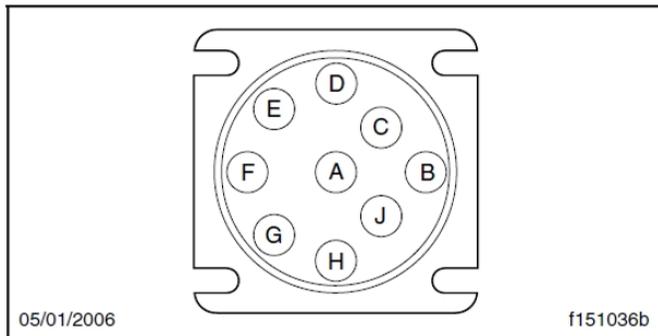
Diagnostic Connector		
Pin	**Function**	
A	Battery (−)	
B	Battery (+)	
C	J1939 CAN High (+)	H1939-CAN High (+)
D	J1939 CAN Low (−)	H1939-CAN Low (-)
E	Reserved	
F	Reserved	
G	Reserved	
H	Diagnostic CAN High (+)	
J	Diagnostic CAN Low (−)	

J1939 (J1939-Open or 250k)

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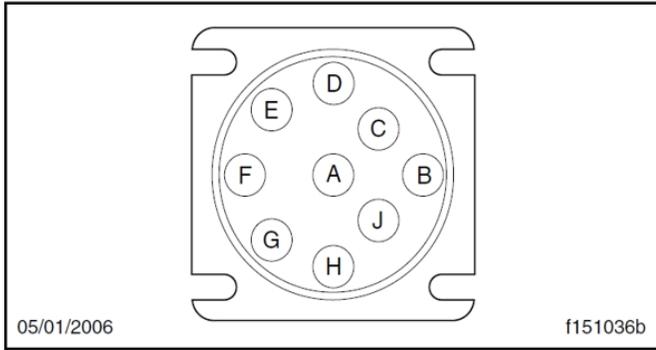
Diagnostic Connector	
Pin	Function
A	Battery (−)
B	Battery (+)
C	J1939 CAN High (+)
D	J1939 CAN Low (−)
E	Reserved
F	J1708/J1587 (+)
G	J1708/J1587 (−)
H	Diagnostic CAN High (+)
J	Diagnostic CAN Low (−)

Notes on the Cabin CAN Datalink

The Cabin CAN datalink uses a "star" network topology. The piece of hardware that connects the different components of the Cabin CAN datalink is called the "StarPoint Connector." Each leg of the Cabin CAN extends from the StarPoint Connector to an ECU, such as the SAM Cab, and a "star" is formed when multiple legs are connected.

- This is different from the J1939 datalink networks, which uses a "bus" network topology.
- The StarPoint Connector maintains an internal resistance value of 60 ohms for each leg of the network, similar to the terminating resistors on J1939.