Workhorse Custom Chassis Tech Tip

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Communication Data Buss Diagnostics

J1939, J1708, J1587, GMLAN, J1850 (Class 2), RS232 & RVC (Recreational Vehicle Communication)

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This document is an overview on how to check different communication busses. This document along with DMM (Digital Multi Meter) & chassis schematics should greatly aid you in strategy based diagnosis of your communication data buss errors.

Note: When checking for communication buss faliure make your checks during the condition when possible or diagnostic time will increase.
If the condition cannot be duplicated make sure to perform wiggle, pull, twist and tap tests with meter install check for change in values.

J1939 Diagnostics

Overview:

J1939 Data Link Cable

The J1939 data link consists of a twisted pair of insulated, multi-stranded copper wires. One of the wires or conductors has yellow insulation, the other has green. The yellow insulated conductor is identified as CAN_H; the green is CAN_L (or CAN + and CAN -, respectively). There are two types of cable that meet the specifications of J1939. These two types of cable are shielded or non-shielded. With the shielded type cable, a non-insulated copper wire is wrapped around the twisted pair. This non-insulated copper wire is referred to as the drain wire. The three-wire set is then wrapped with a layer of metallic foil. This foil is referred to as shielding. A plastic jacket is then molded around the shielded-twisted pair of wires to provide wear resistance and to hold everything in place. Shielded cable meeting the specifications of SAE J1939 is identified as J1939/11. Non-shielded cable consists of the twisted pair of conductors with a molded plastic jacket. Non-shielded cable meeting the specifications of SAE J1939 is identified as J1939/15. Some J1939 cables utilize shielded J1939/11 cable outside of the cab and non-shielded J1939/15 cable inside the cab. Some trucks utilize non-shielded J1939/15 cable both inside and outside the cab.
On the J1939 it is a necessary to terminate each end of the J1939 backbone with a resistor. Each terminating resistor has a value of 120 Ohms. This is a "real" resistance, which can be measured using an Ohmmeter.

1. Check for DTC's

- A communications buss error will log a code when there is a loss of communication from other modules. So even if you're not having current problems you still need to check the codes in all modules that are on the communication buss you are diagnosing.

- If you can't get codes from anything, go on to step 2.

2. **Check voltage: pin C to ground and from pin D to ground at the diagnostic connector with the key on.**

- You should have approximately 5v total when you add the voltages from each wire together, i.e. 2.7v on one and 2.3v on the other.
- These 2 wires should not have exactly the same voltage on them. If they do, you might have the 2 wires shorted together. Check the resistance between the 2 wires.
- If you get 0v or close to it on either wire, you probably have a short to ground on that wire.
- If no trouble found go to step 3.

3. **Check resistance between pins C and D at the diagnostic connector with the key off.**

- You should have approximately 60 ohms.
- There are two 120 ohm resistors in the datalink.
- If you get 0 ohms, then you have a short between the 2 wires.
- If you get 120 ohms, you have an open somewhere in the datalink or you're missing one of the resistors.
- If resistance checks are good go to step 4.

4. **Check the resistance from pin C to ground and from pin D to ground at the diagnostic connector with the key off.**

- Resistance should be greater than 1,000 ohms.
- If resistance is less than 1,000 ohms, then you have a short to ground.
- If resistance is greater than 1,000 ohm go to step 5.

5. **If none of the modules are communicating and they are powered up, you probably have either a short to ground, short to power, or a short between the 2 wires.**

- Make checks 3 & 4 at the pass thru connector (where the chassis harness comes through the bulkhead) on both sides of the connector. This will narrow your problem down to either inside the cab or outside the cab. Use the appropriate circuit diagram to find the pin numbers and connector numbers for your truck.

6. **If you still can't find the problem, write down your codes and measurements from the steps above and contact Workhorse Custom Chassis TAC dept.**

J1708 Diagnostics

Overview:

J1708 Drivetrain Data Link

The J1708 data link is used to permit communications between the drivetrain controllers.
The wire is an insulated twisted pair. The J1708 Drivetrain data link does not require terminating resistors. The primary purposes of this data link is for diagnostics and module programming on modules such as the ABS controller.

1. **Check for DTC's:**
   Using the proper diagnostic software check for any codes that may apply to the J1708 buss

2. **Check connections:**
   At each end of the J1708 buss of every module using proper schematics check for poor connections

3. **Check for shorts to ground:**
   At the diagnostic connector check each pin for shorts to ground

4. **Check for shorts to other circuits:**
   With modules disconnected check the two J1708 circuits for continuity to each other, this reading should read infinite

5. **Check for shorts to power:**
   Using your DMM (Digital Multi Meter) check each J1708 line for shorts to voltage, this should be zero volts with all related modules disconnected

6. **Check circuit resistance:**
   Using DMM (Digital Multi Meter) check from end to end each of the J1708 circuits, this reading should be under 5-ohms

7. **If you still cannot find a problem write down any codes and measurements and call Workhorse TAC dept.**

J1587 Diagnostics

Overview:

J1587 Drivetrain Data Link

The J1587 data link is used to permit communications between the drivetrain controllers.
The wire is an insulated twisted pair. The J1587 data link does not require terminating resistors. The primary purposes of this data link are for diagnostics and module programming on modules such as the ABS controller.

1. **Check for DTC's:**
   Using the proper diagnostic software check for any codes that may apply to the J1587 buss

2. **Check connections:**
   At each end of the J1587 buss of every module using proper schematics check for poor connections

3. **Check for shorts to ground:**
   At the diagnostic connector check each pin for shorts to ground

4. **Check for shorts to other circuits:**
   With modules disconnected check the two J1587circuits for continuity to each other, this reading should read infinite

5. **Check for shorts to power:**
   Using your DMM (Digital Multi Meter) check each J1587 line for shorts to voltage, this should be zero volts with all related modules disconnected

6. **Check circuit resistance:**
   Using DMM (Digital Multi Meter) check from end to end each of the J1587 circuits, this reading should be under 5-ohms

7. **If you still cannot find a problem write down any codes and measurements and call Workhorse TAC dept.**

GM LAN Diagnostics

Overview:

GMLAN Data Link Cable

The communication among control modules is performed through the GMLAN high speed serial data circuit and the GMLAN low speed serial data circuit. The modules that need real time communication are attached to the high speed GMLAN network. The body control module (BCM) is the gateway between the networks. The purpose of the gateway is to translate serial data messages between the GMLAN high speed buss and the GMLAN low speed buss. The gateway will interact with each network according to that network's transmission protocol.

The GMLAN data link consists of a twisted pair of insulated, multi-stranded copper wires.
This cable is shielded. With the shielded type cable, a non-insulated copper wire is wrapped around the twisted pair. This non-insulated copper wire is referred to as the drain wire. The three-wire set is then wrapped with a layer of metallic foil. This foil is referred to as shielding. A plastic jacket is then molded around the shielded-twisted pair of wires to provide wear resistance and to hold everything in place.

On the GMLAN Buss it is necessary to terminate each end of the GMLAN backbone with a resistor. Each terminating resistor has a value of 120 Ohms. This is a "real" resistance, which can be measured using an Ohmmeter.

1. Check for DTC's

- A communications buss error will log a code when there is a loss of communication from other modules. So even if you're not having current problems you still need to check the codes in all modules that are on the communication buss you are diagnosing.
- If you can't get codes from anything, go on to step 2.

2. Check for voltage at pin 8 to ground and from pin 14 to ground at the diagnostic connector.

- You should have no shorts to voltage.
- If no voltage go to step 3.

3. Check resistance between pins 8 and 14 at the diagnostic connector with the key off.

- You should have approximately 60 ohms.
- There are two 120 ohm resistors in the data link.
- If you get 0 ohms, then you have a short between the 2 wires.
- If you get 120 ohms, you have an open somewhere in the data link or you're missing one of the resistors.
- If the ohms checks are good go to step 4.

4. Check the resistance from pin 8 to ground and from pin 14 to ground at the diagnostic connector with the key off.

- Resistance should be greater than 1,000 ohms.
- If resistance is less than 1,000 ohms, then you have a short to ground.
- If resistance is greater than 1,000 ohms go to step 5.

5. If none of the modules are communicating and they are powered up, you probably have either a short to ground, short to power, or a short between the 2 wires.

- Make checks 3 & 4 at the pass thru connector (where the chassis harness comes through the bulkhead) on both sides of the connector. This will narrow your problem down to either inside the cab or outside the cab. Use the appropriate circuit diagram to find the pin numbers and connector numbers for your truck.
- If no trouble found go to step 6.

6. If you still can't find the problem, write down your codes and measurements from the steps above and contact Workhorse Custom Chassis TAC dept.

J1850 (Class 2) Diagnostics

Overview:

J1850 (Class 2) Cable

The J1850 (Class 2) data bus is a single wire communication buss that may or may not implement a star (Splice) network.
The J1850 (Class 2) bus is used for an in-vehicle network in such applications such as ABS, engine, transmission and instrumentation.

1. **Check for DTC's:**
   Using the proper diagnostic software check for any codes that may apply to the J1850 buss

2. **Check connections:**
   At each end of the J1850 buss of every module using proper schematics check for poor connections

3. **Check for shorts to ground:**
   At the 16-pin diagnostic connector check proper pin for shorts to ground

4. **Check for shorts to power:**
   Using your DMM (Digital Multi Meter) check the J1850 line for shorts to voltage, this should be zero volts with all related modules disconnected

5. **Check circuit resistance:**
   Using DMM (Digital Multi Meter) check from end to end each of the J1850 circuits, this reading should be under 5-ohms

6. **If you still cannot find a problem write down any codes and measurements and call Workhorse TAC dept.**

RS232 Diagnostics

Overview:

RS232 Data Link

The RS232 data link is used to permit communications between the drivetrain controllers, diagnostic connectors and laptops
The wire is an insulated twisted pair. The RS232 data link does not require terminating resistors. The primary purposes of this data link are for diagnostics, module interface and module programming on modules such as the Firestone air ride controller.

1. **Check for DTC's:**
   Using the proper diagnostic software check for any codes that may apply to the RS232 buss

2. **Check connections:**
   At each end of the RS232 buss of every module using proper schematics check for poor connections

3. **Check for shorts to ground:**

At the diagnostic connector check each pin for shorts to ground

4. **Check for shorts to other circuits:**
   With modules disconnected check the two RS232 circuits for continuity to each other, this reading should read infinite

5. **Check for shorts to power:**
   Using your DMM (Digital Multi Meter) check each RS232 line for shorts to voltage, this should be zero volts with all related modules disconnected

6. **Check circuit resistance:**
   Using DMM (Digital Multi Meter) check from end to end each of the RS232 circuits, this reading should be under 5-ohms

7. **If you still cannot find a problem write down any codes and measurements and call Workhorse TAC dept.**

RVC (Recreational Vehicle Communication) Diagnostics

Overview:

RVC (Recreational Vehicle Communication) line

The RVC (Recreational Vehicle Communication) data link is used to permit communications between the FCCM (Front Chassis Control Module) & the RCCM (Rear Chassis Control Module) controllers.
The data line is a CAN style insulated & shielded twisted pair.
The RVC (Recreational Vehicle Communication) line requires terminating resistors at 120-ohms each.
The primary purposes of this data link is for communications between CCM's to reduce the amount of harness material needed from the front of a chassis to the rear of the chassis & give enhanced electrical control & diagnostics for all electrical powered accessories.

1. **Check for DTC's:**
   Using the proper diagnostic software check for any codes that may apply to the RVC buss

2. **Check connections:**
   At each end of the RVC buss of every module using proper schematics check for poor connections

3. **Check for shorts to ground:**
   At the diagnostic connector check each pin for shorts to ground

4. **Check for shorts to other circuits:**
   With modules disconnected check the two RVC circuits for continuity to each other, this reading should read infinite

5. **Check for shorts to power:**
   Using your DMM (Digital Multi Meter) check each RVC line for shorts to voltage, this should be zero volts with all related modules disconnected

6. **Check circuit resistance:**
   Using DMM (Digital Multi Meter) check from end to end each of the RVC circuits, this reading should be under 5-ohms

7. **If you still cannot find a problem write down any codes and measurements and call Workhorse TAC dept.**