# PWC Gen2 iBR Diagnostic Tips - Electrical Explained - 133416

**Summary:**
Troubleshooting best practices with detailed view of the iBR connector, verifications to perform, and what to watch out for.

**Type:**
General

**TST Detail:**

## Problem

Many iBR's are replaced due to incorrect diagnostic.  After further analysis, external problems are found to be the cause of the iBR system fault.

## Solution

This document will provide you with tips and tricks to assist in the troubleshooting, and avoid unnecessary iBR replacement.

## Procedure

Use this document in conjunction with PWC Gen2 iBR troubleshooting procedure - 133414 and the shop manual **Shop manual directory - 125002**
Listed below are specific details for troubleshooting and what to look for, including a few real-life examples of failures.

## Where To Start

It is always good practice to confirm the customer's complaint by performing the **IBR SYSTEM FUNCTIONAL TEST** (can be done on dry land).
The main steps are:

- Start the engine on the hose and let idle.**NOTE**: If the iBR gate was not in the neutral position, it will move to the neutral position on engine start-up.
- Depress the throttle lever slightly and visually confirm the iBR gate moves to the forward position, then release the throttle. The iBR gate must remain in the forward position.
- Depress the iBR lever fully and confirm the iBR gate moves to the full down position
- Release the iBR lever completely and confirm the iBR gate moves to the neutral position

## Battery

The battery condition and connections are often overlooked. Verify that;

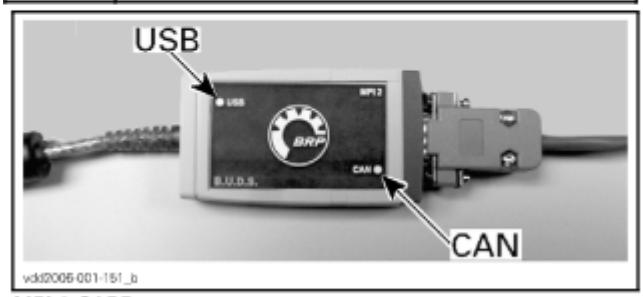
- the battery is fully charged and is at a minimum of 12.6V. Recharge if needed before moving forward with diagnostic
- the battery connections are nice and tight (loose terminals will cause random concerns)

- no corrosion on battery terminals or excess grease causing a connection problem

# Scanning for Faults - BUDS

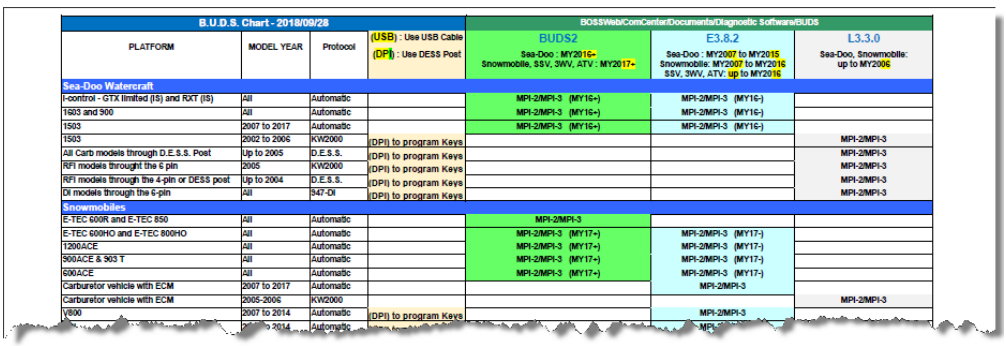
Make sure to use the correct version of BUDS. Refer to the B.U.D.S. Directory - All Products for the BUDS chart to identify which version of BUDS is required for your model.

| COMMUNICATION PROBLEM (CAN) | |
|---|---|
| STATUS | WHAT TO DO |
| CAN Light is OFF | – BUDS2 does not communicate with the vehicle.<br>– Check connections from computer to vehicle.<br>– Check if BUDS2. is started.<br>– Check if vehicle is powered: is cluster turned ON? If it is not ON, install the tether cord cap (D.E.S.S. key) on the engine cut-off switch. |
| CAN Light is RED | This occurs when BUDS2 looses communication with vehicle.<br>– Check connections from computer to vehicle.<br>– Check if vehicle is powered: is cluster turned ON? If not, install the tether cord cap (D.E.S.S. key) on the engine cut-off switch. |
| CAN Light is GREEN | – Connections are GOOD. BUDS2 communicates normally with the vehicle. |



*MPI-2 CARD*

Refer to the above diagram for connection issues with the unit.



| B.U.D.S. Chart - 2018/09/28 | | | | BOSSWeb\ComCenter\Documents\Diagnostic Software\BUDS | | |
|---|---|---|---|---|---|---|
| PLATFORM | MODEL YEAR | Protocol | (USB) : Use USB Cable<br>(DPI) : Use DESS Post | BUDS2<br>Sea-Doo : MY2016+<br>Snowmobile, SSV, 3WV, ATV : MY2017+ | E3.8.2<br>Sea-Doo : MY2007 to MY2015<br>Snowmobile: MY2007 to MY2016<br>SSV, 3WV, ATV: up to MY2016 | L3.3.0<br>Sea-Doo, Snowmobile:<br>up to MY2006 |
| **Sea-Doo Watercraft** | | | | | | |
| i-control - GTX limited (IS) and RXT (IS) | All | Automatic | | MPI-2/MPI-3 (MY16+) | MPI-2/MPI-3 (MY16-) | |
| 1503 and 900 | All | Automatic | | MPI-2/MPI-3 (MY16+) | MPI-2/MPI-3 (MY16-) | |
| 1503 | 2007 to 2017 | Automatic | | MPI-2/MPI-3 (MY16+) | MPI-2/MPI-3 (MY16-) | |
| 1503 | 2002 to 2006 | KW2000 | (DPI) to program Keys | | | MPI-2/MPI-3 |
| All Carb models through D.E.S.S. Post | Up to 2005 | D.E.S.S. | (DPI) to program Keys | | | MPI-2/MPI-3 |
| RFI models through the 6 pin | 2005 | KW2000 | (DPI) to program Keys | | | MPI-2/MPI-3 |
| RFI models through the 4-pin or DESS post | Up to 2004 | D.E.S.S. | (DPI) to program Keys | | | MPI-2/MPI-3 |
| DI models through the 6-pin | All | 947-DI | (DPI) to program Keys | | | MPI-2/MPI-3 |
| **Snowmobiles** | | | | | | |
| E-TEC 600R and E-TEC 850 | All | Automatic | | MPI-2/MPI-3 | | |
| E-TEC 600HO and E-TEC 800HO | All | Automatic | | MPI-2/MPI-3 (MY17+) | MPI-2/MPI-3 (MY17-) | |
| 1200ACE | All | Automatic | | MPI-2/MPI-3 (MY17+) | MPI-2/MPI-3 (MY17-) | |
| 900ACE & 903 T | All | Automatic | | MPI-2/MPI-3 (MY17+) | MPI-2/MPI-3 (MY17-) | |
| 600ACE | All | Automatic | | MPI-2/MPI-3 (MY17+) | MPI-2/MPI-3 (MY17-) | |
| Carburetor vehicle with ECM | 2007 to 2017 | Automatic | | | MPI-2/MPI-3 | |
| Carburetor vehicle with ECM | 2005-2006 | KW2000 | | | | MPI-2/MPI-3 |
| V800 | 2007 to 2014 | Automatic | (DPI) to program Keys | | MPI-2/MPI-3 | |
| | 2007 to 2014 | Automatic | | | MPI-2 | |

The picture above is the example of the BUDS chart. This will identify the BUDS version needed to properly communicate with the unit.
**NOTE**: Use of the incorrect BUDS may create irreversible damage or provide the wrong trouble codes.

**Important:** Some important factors to keep in mind when you experience connection problems are;

- power down the unit, then power back on and retry
- perform the scan twice

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- battery voltage too low
- too much grease in the iBR connector
- improper connection

Some MY 19 clusters will scroll "iBR error" at start-up with the new clusters. This is due to the startup speed of the cluster being too quick, however, there is a software update to address this concern. The unit may or may not show a fault code for this.

# Dielectric Grease in Connectors

Dielectric grease is used from the factory to protect against corrosion damage but also to lubricate the connector's seal.

Cases of excessive dielectric grease have been reported, causing BRLS faults for example. Since the BRLS signal uses very low voltages, it's easily affected by the grease which is a NON-conductive grease.

Gently use an air blow gun to remove excess grease and clean the connector with a good contact cleaner. **Do not use brake cleaner as it will cause a varnish buildup on the surface of the terminal and may attack plastic**.

In some cases, simply disconnecting and reconnecting the connector is enough to move the grease off the terminal to fix the concern.

## New Module Programing and/ or existing module updates

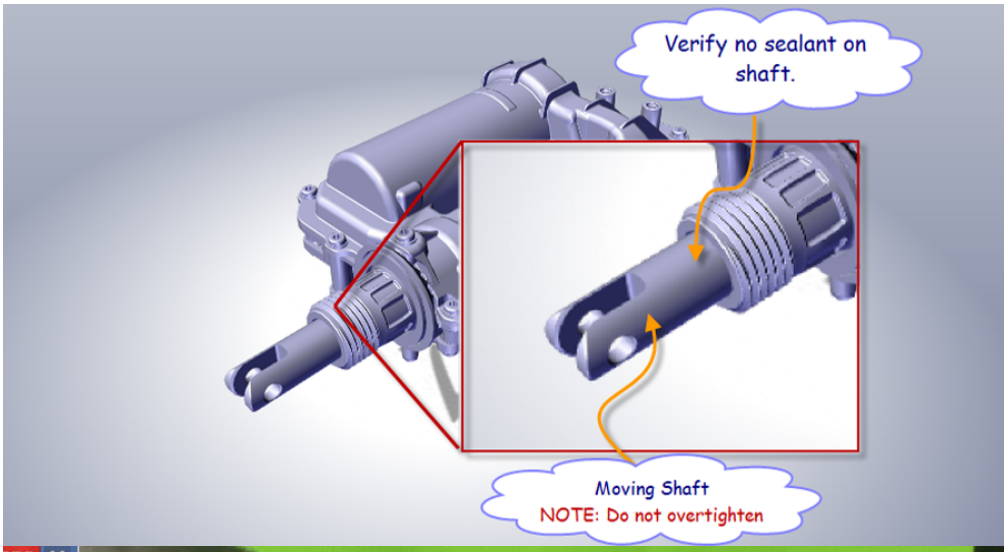
We have received iBR's replaced under warranty deemed as defective, however, only one of the two modules have been programmed. It is important to follow these steps;

- When installing a new iBR both the iBR and the iBR MON must be programmed, see document PWC 2017-3 iBR® Actuator Flash Procedure
- use a booster pack or fully charged secondary battery during the update
- disable screen saver/ auto shut down on your computer to prevent unwanted programming interruption
- once programmed, the iBR must be unlocked and calibrated (see appropriate shop manual for further details)
- if the iBR becomes unresponsive (does not move or auto-calibrate) after programming, power down the unit and BUDS and re-try
- iBR's returned due to programming failure from low voltage, computer shut down, or not fully programmed will not be covered under warranty

### iBR Does not move

If the iBR does not move when requested, you must determine if you are dealing with an electrical or mechanical failure.

- Ensure the iBR gate movement is not obstructed in any way
- Ensure the iBR gate mechanism is in good condition and does not show signs of excessive wear, impact or high friction that would prevent it from moving or causing it to move slowly.
- the moving shaft (see illustration below) does not have any sealant on it, preventing it from moving
- overtightening of the moving shaft can jam the gears in the iBR creating faults and/ or noise (squeaking) When installing the moving arm in the iBR, DO NOT OVERTIGHTEN. It must be loosened in order to line up with the moving gate




## iBR connector

When installed properly the iBR connector offers superior performance under submerged water.

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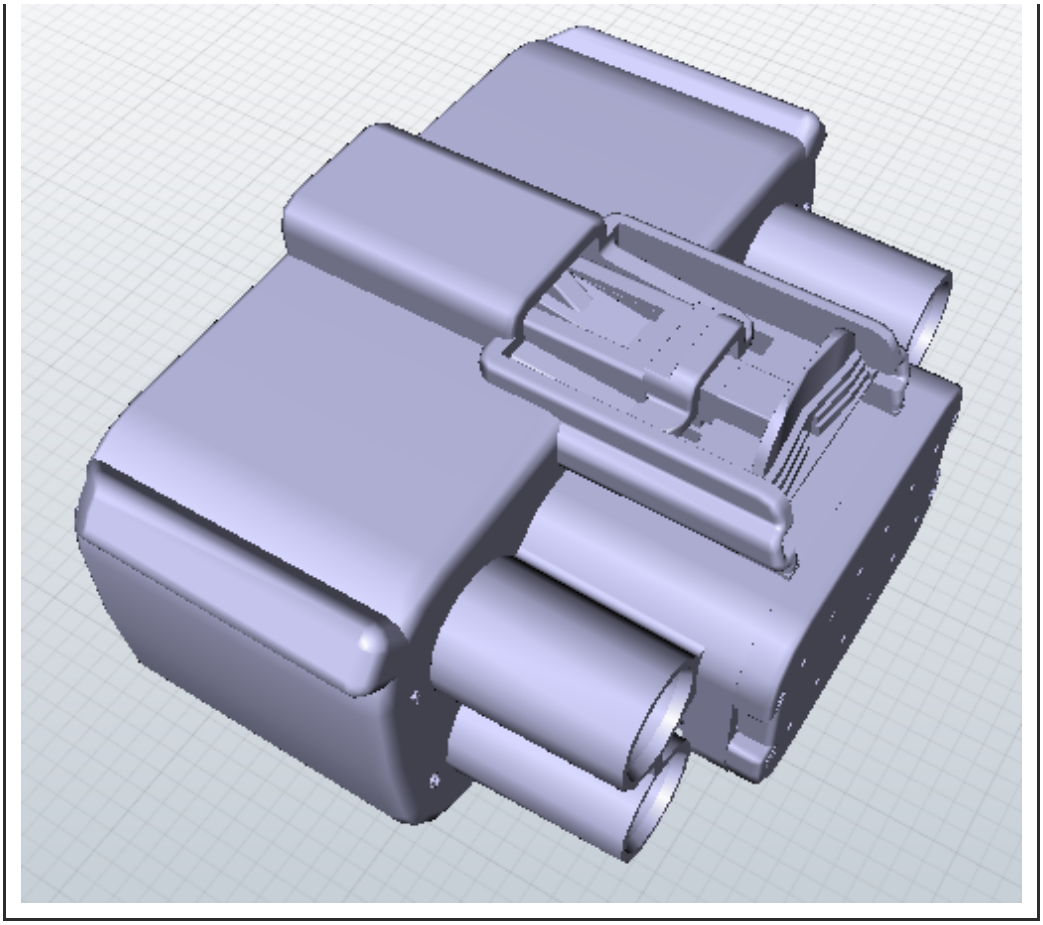
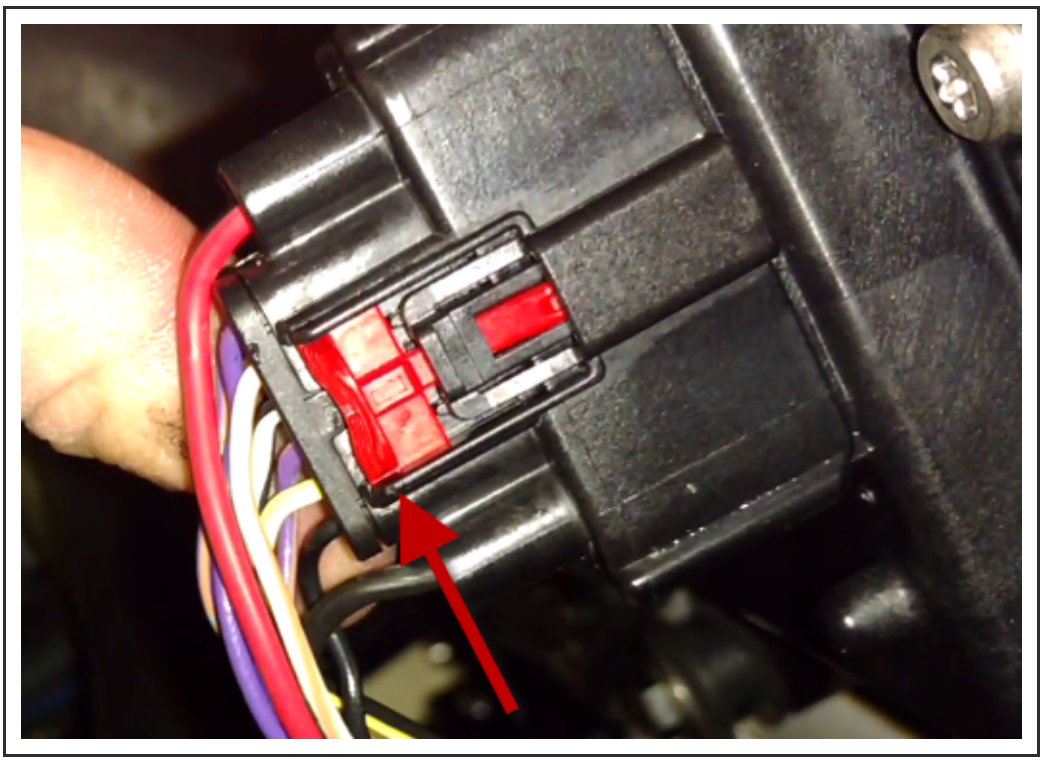


**It is good practice to disconnect and reconnect any component that is being troubleshot.**

**The red locking tab CAN be pushed in the "lock" position before inserting the connector and it can still go all the way in. However, if you don't hear the "click" noise from the retaining clip, this means that the connector is not fully connected. The red locking tab can lead you in the wrong direction... Don't think that you connected it correctly just because the red tab can be pushed in the lock position! Try pulling it back out after locking it.**



## Red locking tab must be in the "unlock" position to remove the connector

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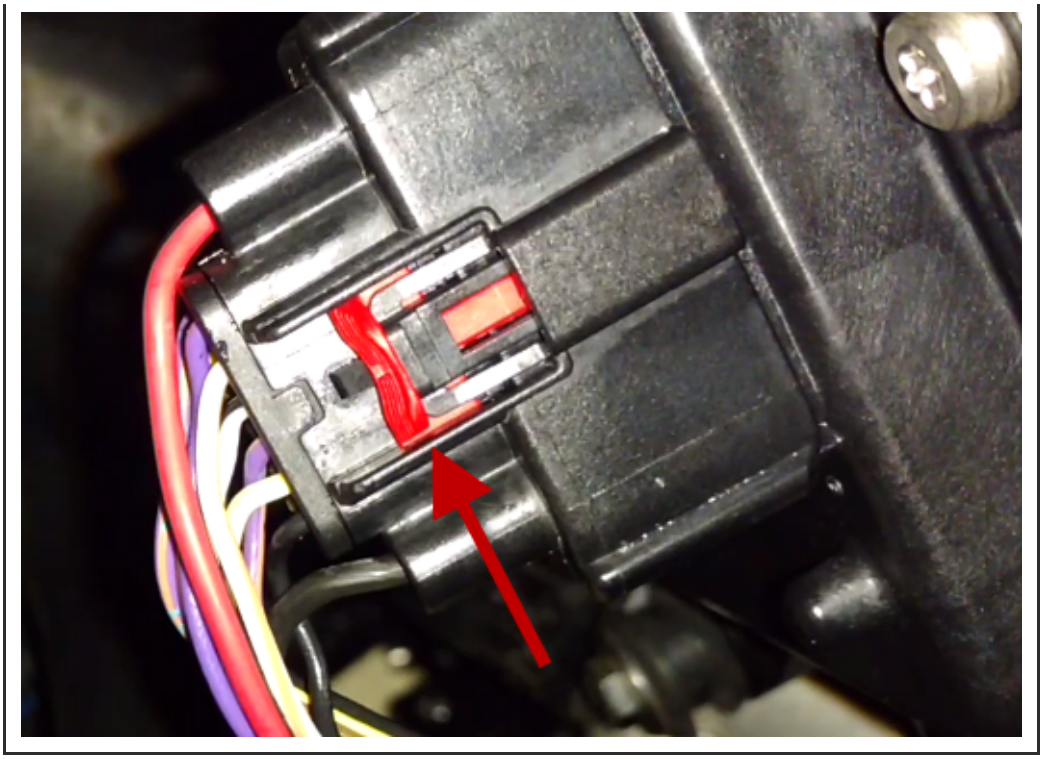
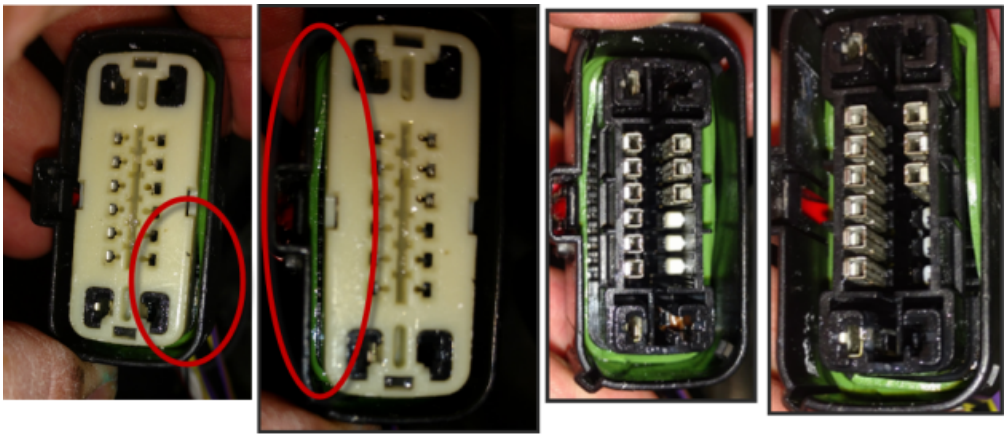
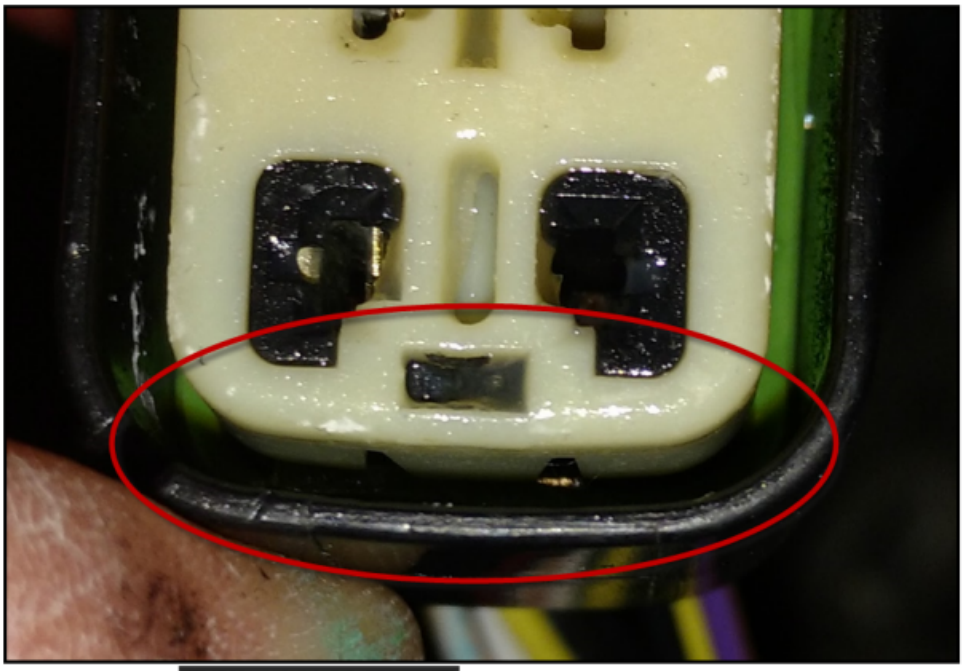


**Red locking tab CAN be in the "locked" position even if not connected all the way in**

## Why can't I properly lock the connector in place?

More than likely the connector's seal has moved out of its location and is being pinched. It's a little hard to see when the white plastic piece is in place but look closely or pry it out, you may have a surprise!



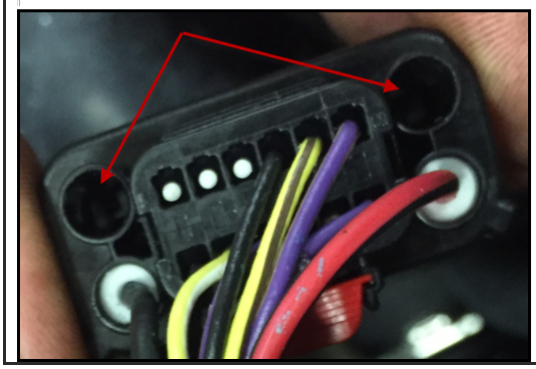


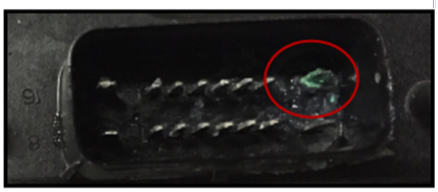
## Consequences of a bad seal

When the above seal is damaged, water may infiltrate. In saltwater, it is even more critical to have a good seal.
Corrosion will occur and it can also happen from a bad wire seal. A brown sealant is used to seal the 2 large, unused, terminals.

Summary

| Code | State | Module | Count | Total Time | Description |
|---|---|---|---|---|---|
| **C2102 | Occurred | IBR | 10 | 0060h17 | Actuator movement |





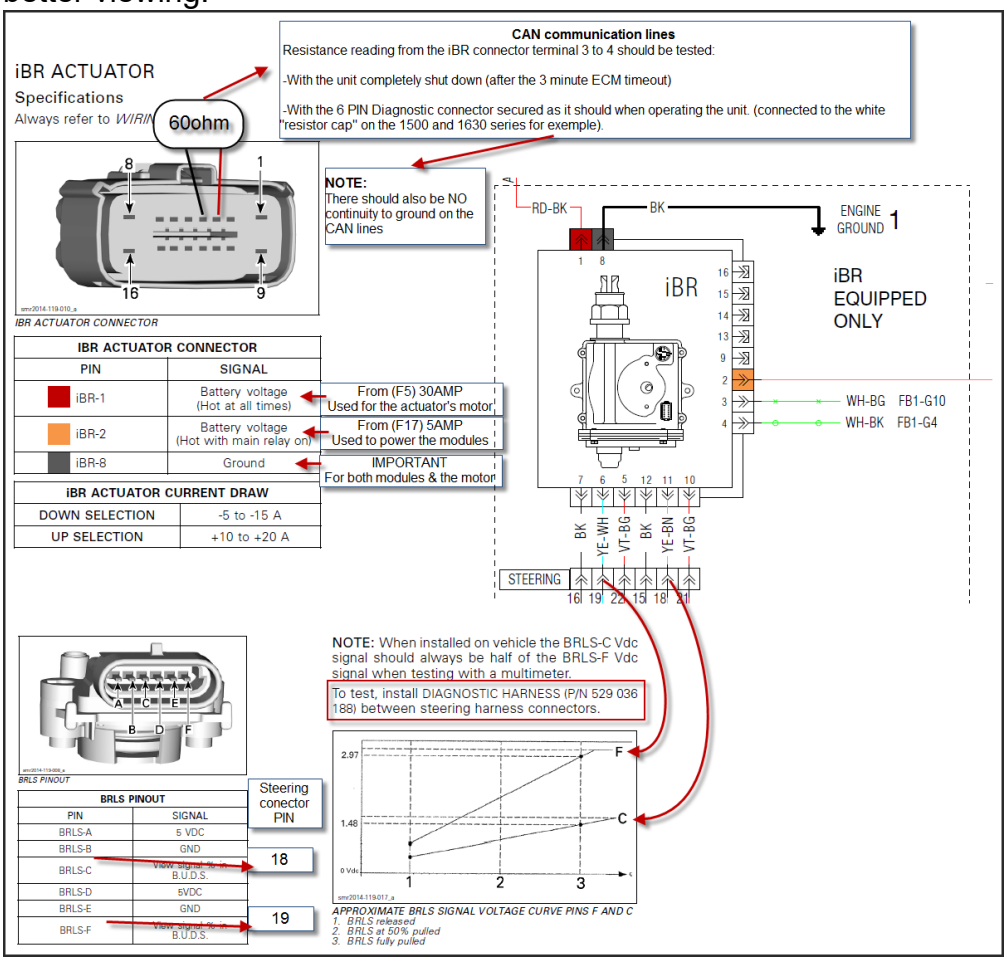
## Terminal pushed out and loose terminals

A terminal may not be fully inserted and move out of the connector during installation. This can cause various faults. A simple pull test is best to confirm the terminal is locked in place or, use the appropriate terminal tool.

## Testing the incoming signal at the connector

Once the connector is inspected, the next step is to confirm that the incoming signals and voltages are good.
A one-pager image showing the principal tests to perform. Please **download the attached version** for

better viewing.

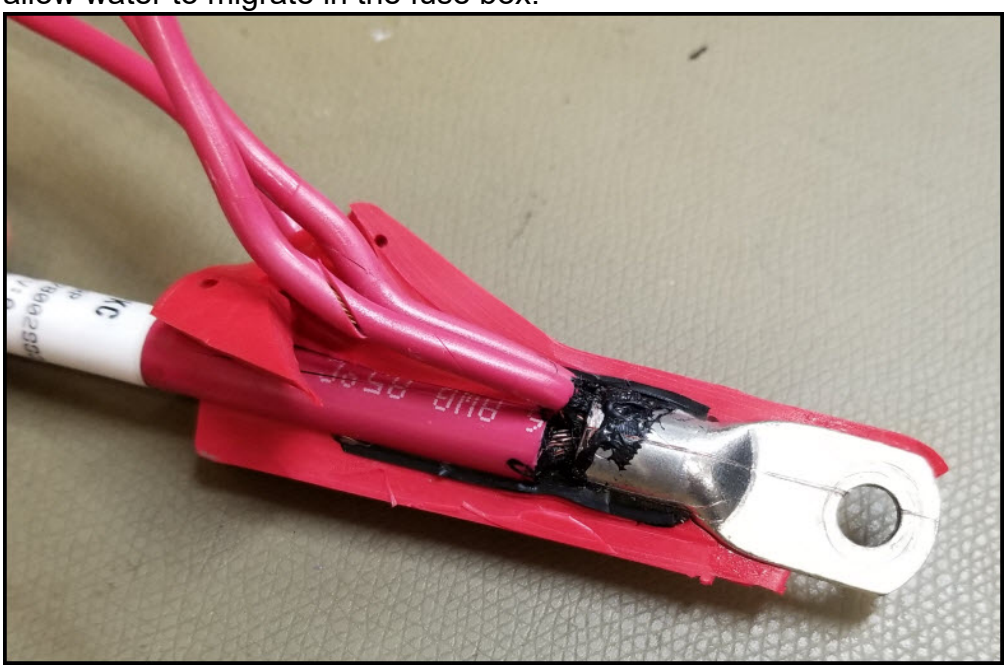



## First, we must check for power on terminal 1 & 2

Possible problems seen before would be

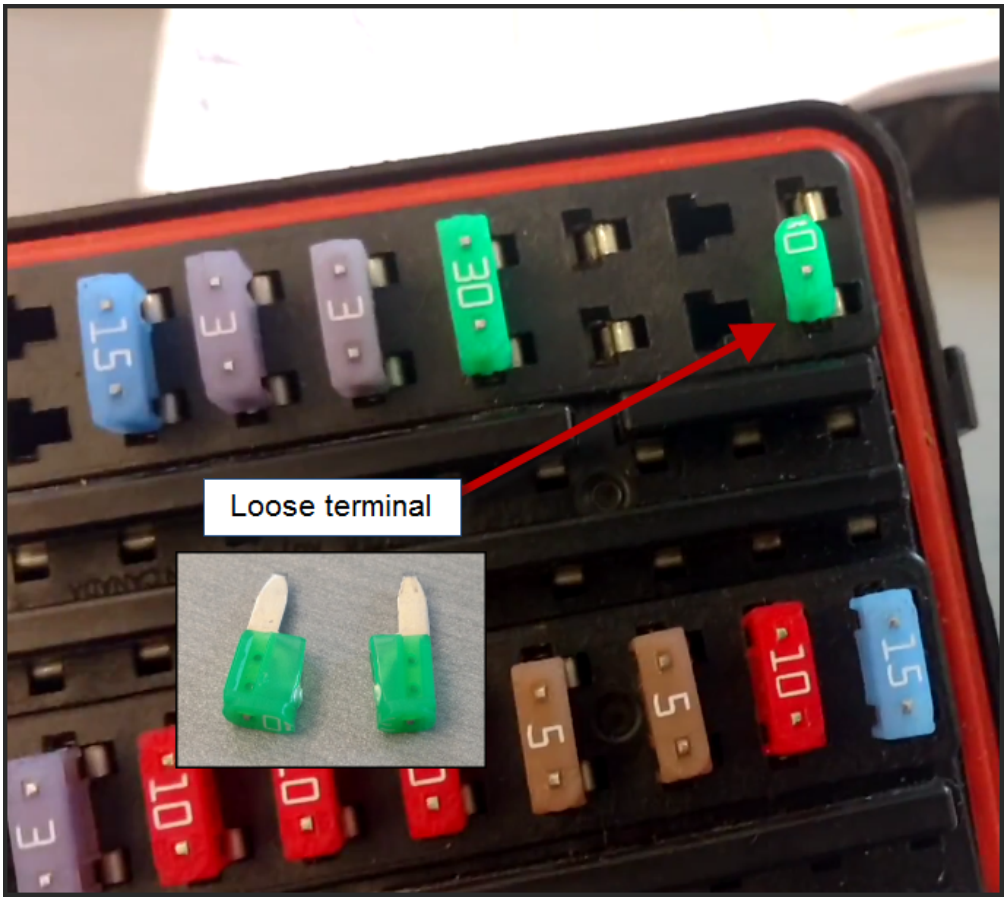
- loose terminals at the fuse box
- bad main relay
- poor starter relay cable junction
- chafing harness (also discussed in the following section about grounds. [PWC 2017-3 Chafing of the Main Harness (Against the Intake Manifold)_132889_WCN21Y017S10_en]

**The junction at the starter relay** may be corroded inside the rubber-coated junction. this could also allow water to migrate in the fuse box.



**A few loose terminals were reported** on the 30amp fuse also. You may want to cut a fuse and use it

as a terminal testing tool. When inserting and removing the fuse into the terminal, resistance should be felt.

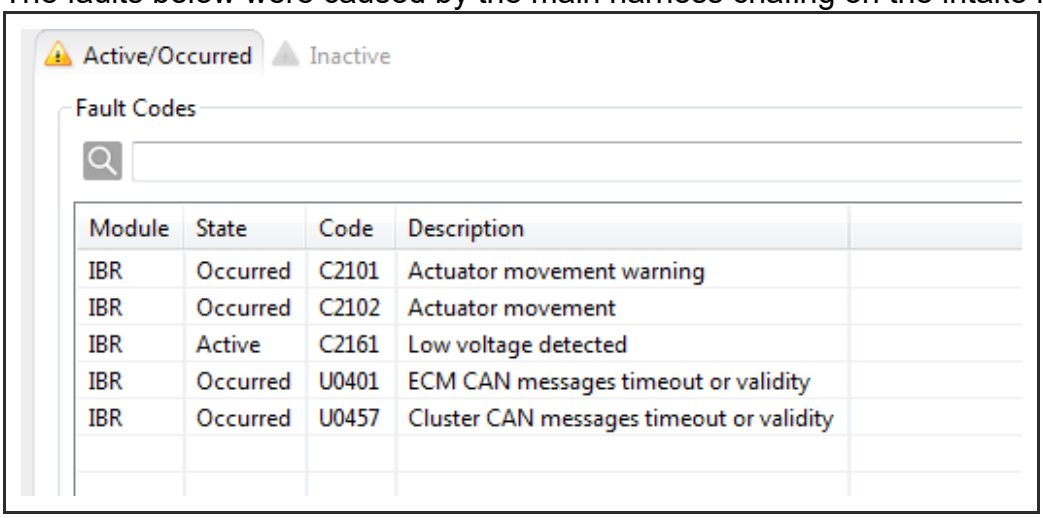



### The Ground on Terminal 8

Possible causes;

- Chafing harness
- Loose or broken grounds
- corrosion

**Chafing harness have been addressed** on GTS-GTI 900 ACE early in 2017.
[PWC 2017-3 Chafing of the Main Harness (Against the Intake Manifold)_132889_WCN21Y017S10_en]
The faults below were caused by the main harness chafing on the intake manifold.

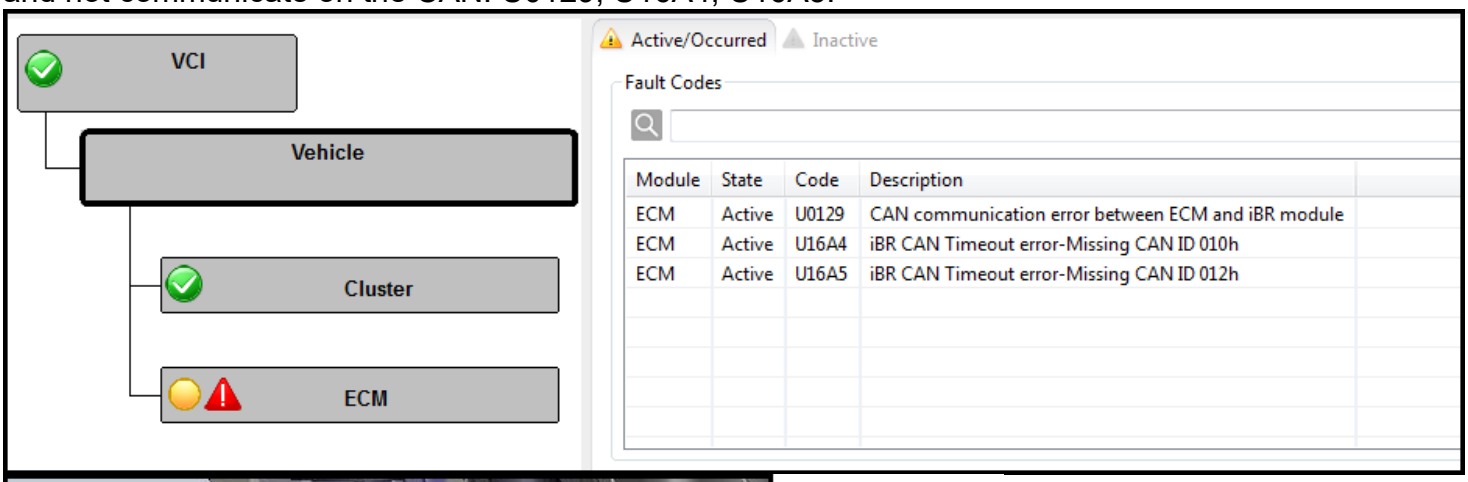


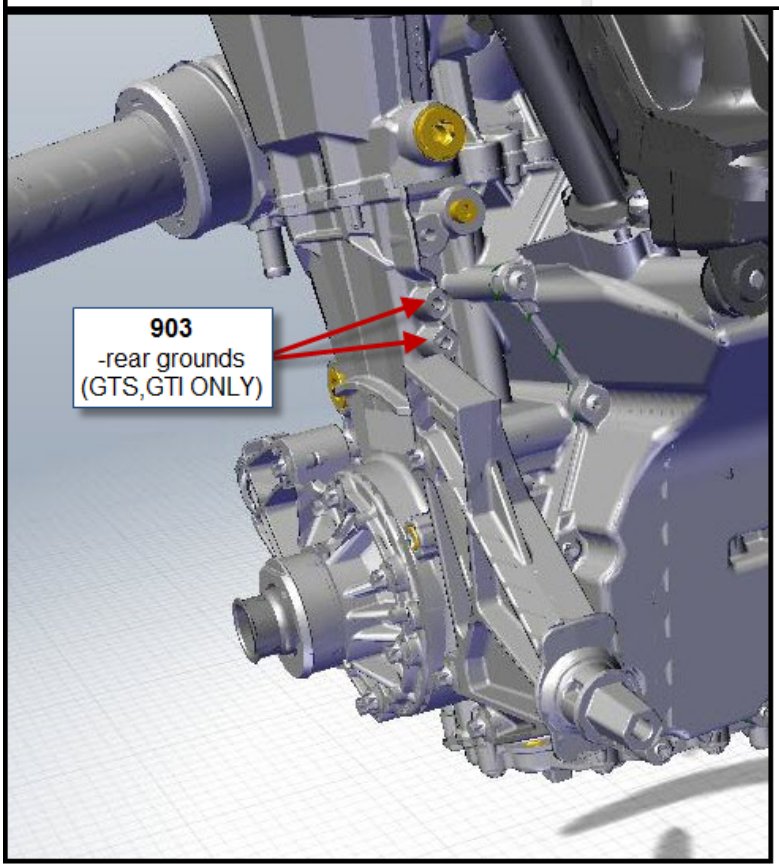

| Module | State | Code | Description |
|---|---|---|---|
| IBR | Occurred | C2101 | Actuator movement warning |
| IBR | Occurred | C2102 | Actuator movement |
| IBR | Active | C2161 | Low voltage detected |
| IBR | Occurred | U0401 | ECM CAN messages timeout or validity |
| IBR | Occurred | U0457 | Cluster CAN messages timeout or validity |

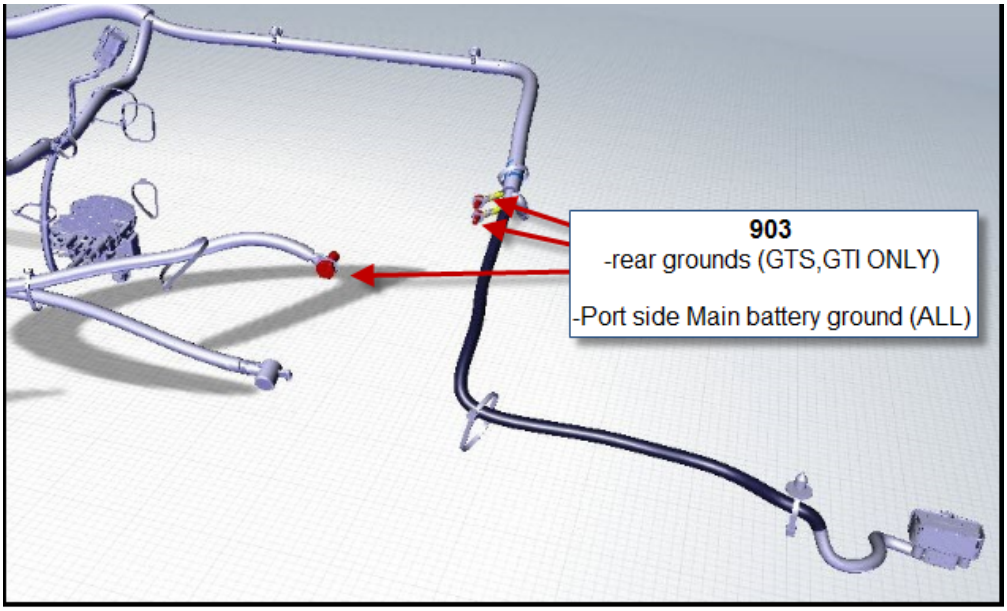
In this case, the most important fault is C2161 Low voltage detected. Low voltage will trigger many other faults.
**C2101 & C2102:**
The actuator's motor needs good voltage from the 30amp fuse to move the reverse gate as ordered and expected by the module. Otherwise, the module will trigger a fault for its movement not being appropriate.

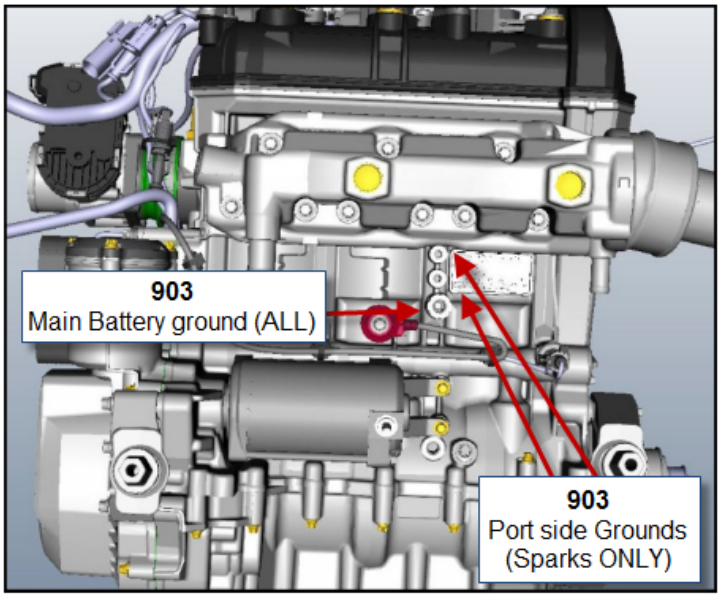
**C2161:**
The module will also shut down if the voltage between the 5amp fuse and the PIN 8 ground goes below a certain threshold.
**U0491 & U0457:**
CAN communication faults are often caused by the modules shutting down unexpectedly.

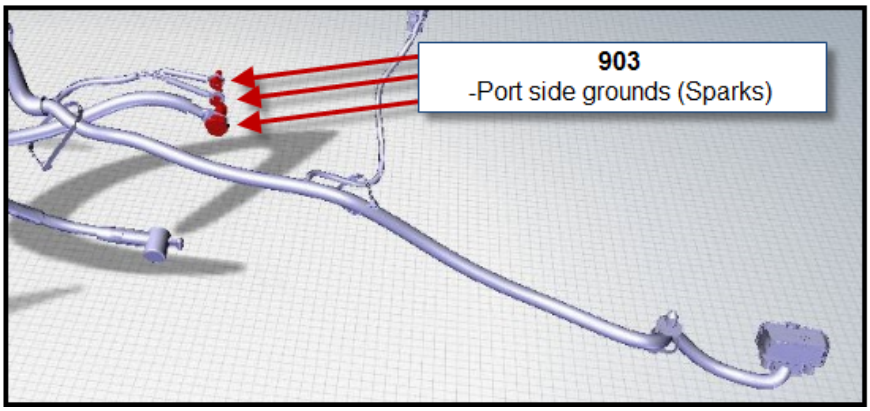
**Some loose grounds have been reported.**
In some cases it would trigger a low voltage fault. In other cases, it would cause the iBR to shut down and not communicate on the CAN. U0129, U16A4, U16A5.






### The CAN wires

The CAN wires must be tested if the unit doesn't communicate with BUDS or the other modules.

- BUDS must be disconnected
- The 6 pin diagnostic connector must be plugged in its protective cap (resistor cap on some model)
- The electrical must be shut down completely, after the ECM shutdown (up to 5 minutes) or remove and install Main Relay to shut ECM off.
- If the diagnostic connect is not properly stored, water may short the connection causing random electrical faults

Then resistance check can be performed

| Measure at | Specifications |
| --- | --- |

| | |
|---|---|
| iBR-3 to iBR-4 | 54 - 62 Ω |
| iBR-3 to GND | Above 2K Ω |
| iBR-4 to GND | Above 2K Ω |

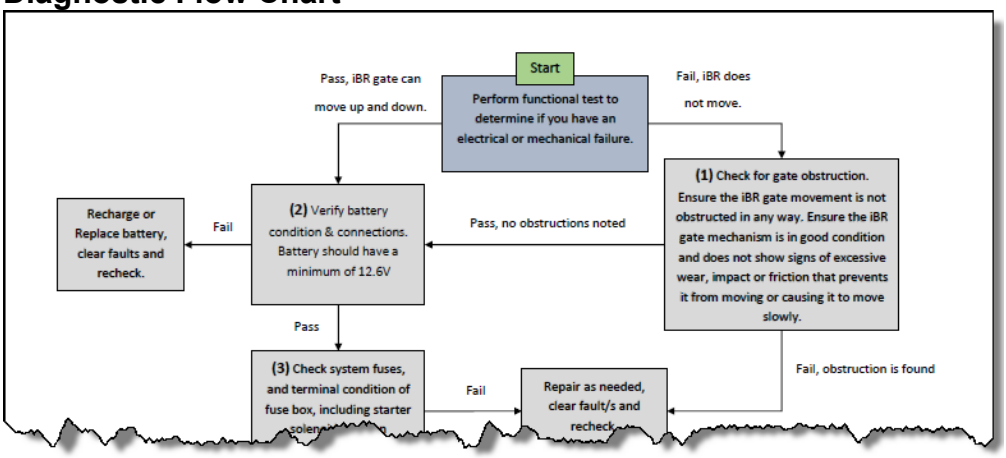
If you measure a short-circuit or a lower resistance than specified, there might be a defective module connected to the CAN network. Try disconnecting **one module at a time** and see if the short-circuit disappears.

If no defective module was found, the complete harness must be checked for potential short caused by pinched or worn wires. Ensure that all modules are unplugged from the CAN network and measure with an ohmmeter.

## The BRLS signals

Using a Steering connector diagnostic harness, verify the signal going out of the sensor to the iBR.
If the signal is no good, verify the 5v reference and the ground going into each sensor.
Refer to the shop manual for all the specifications, and tests for the BRLS, with expected results.
**Shop manual directory - 125002**

### Diagnostic Flow Chart




**Refer to the Printable Diagnostic Flow Chart PDF**

**Attachment:** connector pinout test.png

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