

SUSPENSION - ELECTRONIC REAL TIME DAMPING

1998 Pontiac Bonneville

1998-99 SUSPENSION
Electronic - Real Time Damping
GM

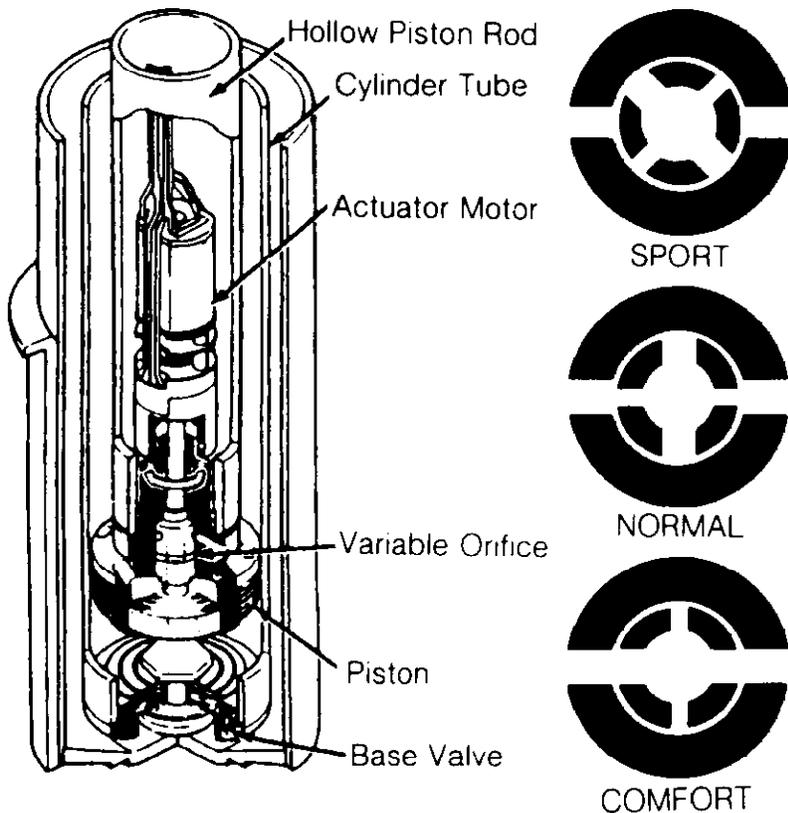
Bonneville

DESCRIPTION & OPERATION

NOTE: In some literature, Computer Command Ride/Real Time Damping (CCR/RTD) system may be referred to as simply CCR or RTD.

Computer Command Ride/Real Time Damping (CCR/RTD) system controls the firmness of vehicle ride based on driver selection, vehicle speed, lateral acceleration and lift/dive. CCR/RTD control module controls an electric actuator in each strut. The actuator rotates a selector valve that has 3 different sized orifices. The position of the selector valve affects the firmness of the strut damping characteristics. See Fig. 1.

Actuators are an integral part of strut and are not serviceable separately from strut. System has self-diagnostic feature that stores codes in control module memory if system fault occurs. See SELF-DIAGNOSTICS.



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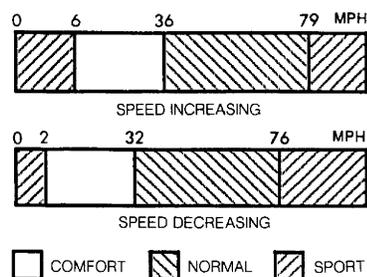
Fig. 1: Cross-Sectional View Of Strut Assembly
Courtesy of General Motors Corp.

DRIVER SELECTION INPUT

Driver select switch (if equipped) allows the driver to select TOURING or PERFORM ride. When TOURING ride is selected, system adjusts ride firmness based on vehicle speed and lateral acceleration. When PERFORM ride is selected, ride is always firm regardless of vehicle speed and lateral acceleration. See Fig. 2.

VEHICLE SPEED INPUT

Vehicle speed affects ride firmness. See Fig. 2. CCR/RTD control module receives vehicle speed signal from the Powertrain Control Module (PCM).



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Fig. 2: Identifying Computer Command Ride System Operating Parameters
Courtesy of General Motors Corp.

LATERAL ACCELERATION INPUT

Lateral acceleration refers to sideways inertia that occurs when turning. When lateral acceleration reaches a certain value, contacts in lateral accelerator switch close. When this occurs, the CCR/RTD control module commands the selector valve to rotate to the SPORT (firm) mode to prevent vehicle roll.

LIFT/DIVE INPUT

Lift and dive occur when the vehicle accelerates and decelerates. When the PCM calculates that the vehicle is lifting or diving (based on vehicle speed signal), the PCM provides a signal to the CCR/RTD control module.

COMPONENT LOCATIONS

COMPONENT LOCATIONS

Component	Location
Actuator	Integral Part Of Strut
Data Link Connector (DLC)	Under Steering Column
Computer Command Ride (CCR) Control Module	Under Driver's Seat
Lateral Acceleration Switch	Under Driver's Seat
Powertrain Control Module (PCM)	Left Front Of Engine Compartment, In Air Cleaner

SELF-DIAGNOSTICS

Operation

If CCR/RTD system detects a fault, a code is set in control

module memory and both LEDs on select switch are illuminated. When a code is not present, one LED illuminates, indicating switch position). LEDs will remain illuminated as long as fault is present. If fault is no longer present, LEDs will go out but code will be retained in CCR/RTD control module memory. As long as a code is set in memory, system performs a one-second self-diagnostic test every 3 minutes and whenever select switch position is changed. During this one-second self-diagnostic test, both LEDs will illuminate. If fault is corrected, LEDs will go out. If fault remains, LEDs will stay on.

DIAGNOSIS & TESTING

RETRIEVING CODES

1) Connect a jumper wire between Light Green wire and Black wire terminals of Data Link Connector (DLC). Turn ignition on. Observe LEDs on select switch.

2) LEDs will remain off for 3 seconds, and then both LEDs will flash Code 12 three times (Code 12 is signalled by: FLASH, short pause, FLASH FLASH and a long pause). This marks beginning of sequence.

3) If codes are stored, they will be flashed in ascending order (code of lowest numeric value is flashed first). Each code is flashed 3 times before next code is flashed. When all codes have been flashed, Code 12 will be flashed again, indicating sequence is being repeated.

4) If jumper wire is disconnected from DLC during sequence, the sequence will be aborted. Start procedure again from beginning. For code identification, see CODE IDENTIFICATION table. To repair indicated fault, see DIAGNOSTIC TESTS.

CODE IDENTIFICATION

Code	Description
12	Initialization (System Normal, No Error)
23	Left Front Actuator Position Error
24	Right Front Actuator Position Error
25	Left Rear Actuator Position Error
26	Right Rear Actuator Position Error
31	Lift/Dive Signal Error
32	Lateral Accelerator Switch Error
33	Driver Select Switch Input Error
34	Vehicle Speed Signal Error

CLEARING CODES

Turn ignition on. Connect one end of a jumper wire to Black wire terminal of DLC. Connect other end of jumper wire to Light Green wire terminal of DLC for one second, and then disconnect for one second. Repeat procedure 3 times, pausing one second between connections. When all codes are cleared, LEDs on select switch will go out for one second, and then illuminate for 2 seconds. If LEDs do not go out after 2 seconds, all codes have not been cleared. Repeat procedure.

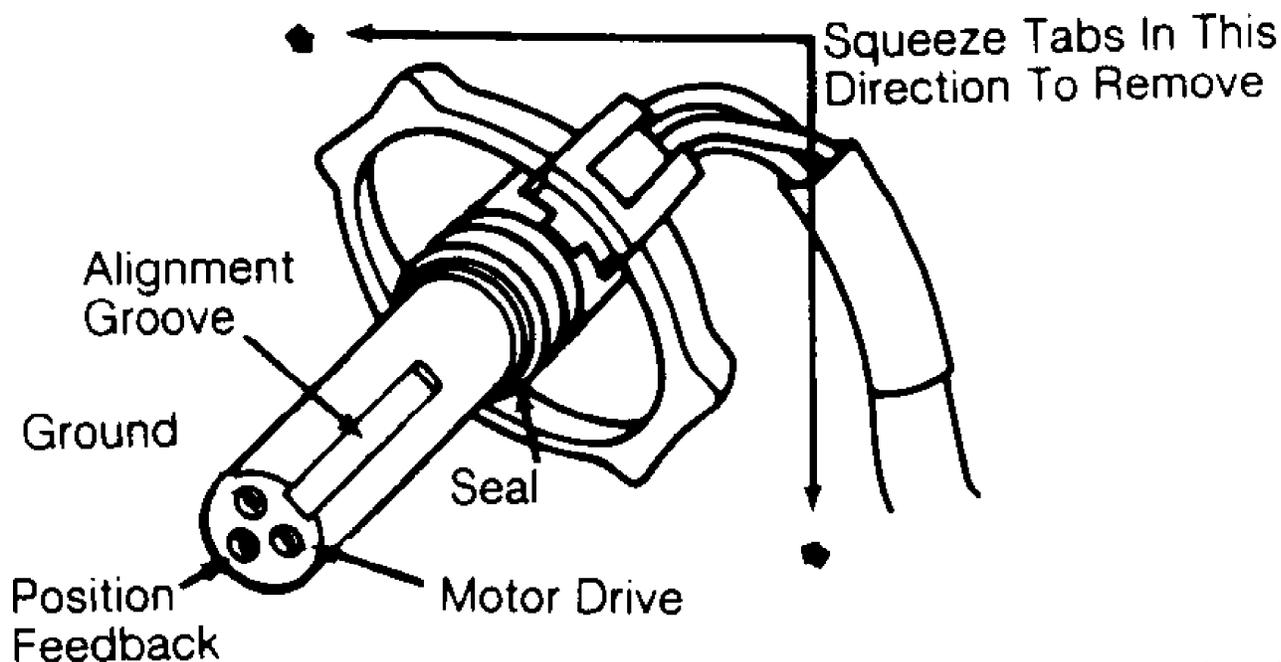
CONTINUOUS STRUT ACTUATOR CYCLING

This procedure enables a diagnostic mode in CCR/RTD control module to cycle each actuator from position to position. CCR/RTD control module holds actuator in each position for 2 seconds and

checks for errors. To start this procedure, connect a 6600-ohm resistor between Black wire and Light Green wire terminals of DLC. If an actuator is faulty, actuator will not cycle until fault is corrected and CCR/RTD control module has performed self-diagnostic test (every 3 minutes).

INTERMITTENT CODES

A false code may be set in cold weather (less than -40°F) because of increased strut fluid viscosity. The Actuator may not reach position in 6 seconds, resulting in the setting of a code. Most intermittent codes are caused by poor electrical connections. Before replacing components, check for corrosion, moisture and dirt at connector terminals, especially at actuator connector and cavity. Check for proper mating of connector halves and damaged terminals. To maintain sealing integrity, disconnect actuator connectors only when necessary. Before connecting, ensure actuator connector cavity is clean and dry, and alignment groove in connector is aligned with slot in connector cavity. See Fig. 3.



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Fig. 3: Identifying Actuator Connector
Courtesy of General Motors Corp.

CCR/RTD SYSTEM CHECK

1) Enter diagnostics. See RETRIEVING CODES. Check and record codes. Exit diagnostics. Clear codes. See CLEARING CODES. Enter diagnostics again and check for codes.

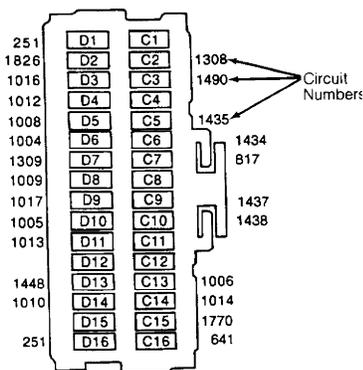
2) If more than one code is set, go to next step. If only one code is set, go to appropriate code for diagnosis. See CODE IDENTIFICATION table. If no codes are set, but were previously set, go to appropriate code for diagnosis, paying special attention to causes of intermittent codes.

3) Disconnect CCR/RTD control module connector. Using DVOM measure resistance between specified terminals of CCR/RTD control

module harness connector. See ACTUATOR RESISTANCE table. See Fig. 4. This measures resistance of actuator in each strut. If resistance of each actuator is not 20-60 ohms, check for poor connection at actuator connector. Repair as necessary. If resistance of each actuator is 20-60 ohms, go to appropriate code for diagnosis. See CODE IDENTIFICATION table.

ACTUATOR RESISTANCE

Actuator	Terminals
Left Front	D13 & D10
Right Front	C13 & D8
Left Rear	D14 & D11
Right Rear	C14 & D9



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Fig. 4: Identifying CCR/RTD Module Connector Terminals
 Courtesy of General Motors Corp.

DIAGNOSTIC TESTS

NOTE: To identify terminals and wire colors referenced in testing, see WIRING DIAGRAMS. To identify CCR/RTD control module connector terminals, use illustration. See Fig. 4. After repairs are complete, recheck system operation to verify problem has been repaired. See CCR/RTD SYSTEM CHECK under DIAGNOSIS & TESTING.

CODES 23, 24, 25 & 26: ACTUATOR POSITION ERROR

- * CODE 23: LEFT FRONT ACTUATOR POSITION ERROR
- * CODE 24: RIGHT FRONT ACTUATOR POSITION ERROR
- * CODE 25: LEFT REAR ACTUATOR POSITION ERROR
- * CODE 26: RIGHT REAR ACTUATOR POSITION ERROR

1) Perform CCR/RTD system check. See CCR/RTD SYSTEM CHECK under DIAGNOSIS & TESTING. After performing CCR/RTD system check, go to next step.

2) Turn ignition off. Disconnect CCR/RTD control module connector. Using DVOM, measure resistance between actuator drive circuit and actuator ground circuit of CCR/RTD control module harness connector. If resistance is 0-2 ohms, go to next step. If resistance is 3-19 ohms, go to step 4). If resistance is 20-60 ohms, go to step 5). If resistance is more than 60 ohms, go to step 12).

3) Disconnect actuator connector. Using DVOM, measure

resistance between actuator drive circuit and actuator ground circuit of CCR/RTD control module harness connector. If resistance is 0-2 ohms, repair short to ground in actuator drive circuit. If resistance is more than 2 ohms, replace strut.

4) Check actuator connector for corrosion, moisture or debris. If connector is okay, replace strut.

5) Reconnect CCR/RTD control module connector. Using DVOM, backprobe measuring voltage between actuator drive circuit and actuator ground circuit of CCR/RTD control module connector. Turn ignition on. If voltage indicates high for about 2-6 seconds after ignition is turned on, go to next step. If voltage does not indicate high for about 2-6 seconds after ignition is turned on, replace CCR/RTD control module.

6) Connect a 6600-ohm resistor between diagnostic enable circuit and system ground circuit of CCR/RTD control module connector. Using DVOM, measure voltage between actuator feedback circuit and actuator ground circuit of CCR/RTD control module connector. If voltage is less than .5 volt, go to step 8). If voltage is .5-4.5 volts, replace strut. If voltage is more than 4.5 volts, go to next step. If voltage fluctuates between 1, 3 and 5 volts, check for intermittents. See INTERMITTENT CODES under DIAGNOSIS & TESTING.

7) Disconnect CCR/RTD control module connector. Using DVOM, measure resistance of actuator feedback circuit between CCR/RTD control module harness connector and actuator connector. If resistance is 0-2 ohms, replace strut. If resistance is more than 2 ohms, repair open in actuator feedback circuit.

8) Turn ignition off. Using DVOM, measure resistance between actuator feedback circuit and actuator ground circuit of CCR/RTD control module harness connector. If resistance is 0-100 ohms, go to next step. If resistance is more than 100 ohms, replace CCR/RTD control module.

9) Disconnect actuator connector. Using DVOM, measure resistance between actuator feedback circuit and actuator ground circuit of CCR/RTD control module harness connector. If resistance is 0-100 ohms, go to next step. If resistance is more than 100 ohms, replace strut.

10) Disconnect CCR/RTD control module connector. Using DVOM, measure resistance between actuator feedback circuit and actuator ground circuit of CCR/RTD control module harness connector. If resistance is 0-20,000 ohms, replace CCR/RTD control module. If resistance is more than 20,000 ohms, go to next step.

11) Disconnect CCR/RTD control module connector and actuator connector. Using DVOM, measure resistance between actuator feedback circuit and actuator ground circuit of CCR/RTD control module harness connector. If resistance is 0-100 ohms, repair short between actuator feedback circuit and actuator ground circuit. If resistance is more than 100 ohms, repair short to ground in actuator feedback circuit.

12) Using DVOM, measure resistance of actuator drive circuit between CCR/RTD control module harness connector and actuator connector. If resistance is 0-2 ohms, go to next step. If resistance is more than 2 ohms, repair open in actuator drive circuit.

13) Using DVOM, measure resistance of actuator ground circuit between CCR/RTD control module harness connector and actuator connector. If resistance is 0-2 ohms, replace strut. If resistance is more than 2 ohms, repair open in actuator ground circuit.

CODE 31: LIFT/DIVE SIGNAL ERROR

1) Perform CCR/RTD system check. See CCR/RTD SYSTEM CHECK under DIAGNOSIS & TESTING. After performing CCR/RTD system check, go to next step.

2) Turn ignition off. Using DVOM, backprobe measuring voltage between WOT input circuit and system ground circuit of CCR/RTD control

module connector. Turn ignition on. Monitor voltage for at least 20 seconds. If voltage is always low, go to step 5). If voltage is always high, go to next step. If voltage starts low then increases after 10 seconds, check for intermittents. See INTERMITTENT CODES under DIAGNOSIS & TESTING.

3) Connect a jumper wire between WOT/brake control circuit of Powertrain Control Module (PCM) and ground. Continue to monitor voltage at WOT input circuit of CCR/RTD control module connector. If voltage remains high, go to next step. If voltage drops, replace PCM.

4) Check for open or short to voltage in WOT circuit between CCR/RTD control module and PCM. Repair as necessary. If circuit is okay, replace CCR/RTD control module.

5) Disconnect PCM connector. Using DVOM, measure voltage between WOT input circuit and system ground circuit of CCR/RTD control module connector. If voltage remains low, go to next step. If voltage increases, replace PCM.

6) Check for short to ground in WOT circuit between CCR/RTD control module and PCM. Repair as necessary. If circuit is okay, replace CCR/RTD control module.

CODE 32: LATERAL ACCELERATOR SWITCH ERROR

1) Ensure vehicle is level. Turn ignition on. Using DVOM, backprobe measuring voltage between lateral accelerator switch input circuit and system ground circuit of CCR/RTD control module connector. If voltage is less than one volt, go to step 6). If voltage is 1-2.5 volts, go to step 5). If voltage is 2.5-4.2 volts, replace lateral accelerator switch. If voltage is 4.2-5.5 volts, go to step 3). If voltage is more than 5.5 volts, go to next step.

2) Check for short to voltage in lateral accelerator switch input circuit and lateral accelerator switch output circuit.

3) Disconnect CCR/RTD control module connector. Using DVOM, measure resistance between lateral accelerator switch input circuit and lateral accelerator switch output circuit of CCR/RTD control module harness connector. If resistance is less than 100 ohms, replace CCR/RTD control module. If resistance is more than 100 ohms, go to next step.

4) Disconnect lateral accelerator switch connector. Using DVOM, measure resistance between terminals of lateral accelerator switch. If resistance is less than 100 ohms, repair open in lateral accelerator switch input circuit or lateral accelerator switch output circuit. If resistance is more than 100 ohms, replace lateral accelerator switch.

5) Clear codes. See CLEARING CODES under DIAGNOSIS & TESTING. Enter diagnostics. See RETRIEVING CODES under DIAGNOSIS & TESTING. If CCR/RTD Code 32 is set, replace CCR/RTD control module. If CCR/RTD Code 32 is not set, replace lateral accelerator switch.

6) Turn ignition off. Disconnect CCR/RTD control module connector. Using DVOM, measure resistance between lateral accelerator switch input circuit and system ground circuit of CCR/RTD control module harness connector. If resistance is less than 1000 ohms, repair short to ground in lateral accelerator switch input circuit. If resistance is more than 1000 ohms, go to next step.

7) Using DVOM, measure resistance between lateral accelerator switch output circuit and system ground circuit of CCR/RTD control module harness connector. If resistance is less than 1000 ohms, repair short to ground in lateral accelerator switch output circuit. If resistance is more than 1000 ohms, replace CCR/RTD control module.

CODE 33: DRIVER SELECT SWITCH INPUT ERROR

1) Turn ignition off. Disconnect CCR/RTD control module connector. Place driver select switch in TOURING position. Using DVOM,

measure resistance between touring switch circuit of CCR/RTD control module harness connector and ground. If resistance is more than 10 ohms, go to step 11). If resistance is 0-10 ohms, go to next step.

2) Using DVOM, measure resistance between perform switch circuit of CCR/RTD control module harness connector and ground. If resistance is more than 500 ohms, go to step 4). If resistance is 0-500 ohms, go to next step.

3) Disconnect driver select switch. Using DVOM, measure resistance between perform switch circuit of CCR/RTD control module harness connector and ground. If resistance is 0-500 ohms, repair short in perform switch circuit. If resistance is more than 500 ohms, replace driver select switch.

4) Using DVOM, measure resistance between perform switch circuit and system ground circuit of CCR/RTD control module harness connector. If resistance is more than 500 ohms, go to next step. If resistance is 0-500 ohms, repair short in perform switch circuit.

5) Place driver select switch in PERFORM position. Using DVOM, measure resistance between perform switch circuit of CCR/RTD control module harness connector and ground. If resistance is more than 10 ohms, go to step 9). If resistance is 0-10 ohms, go to next step.

6) Using DVOM, measure resistance between touring switch circuit of CCR/RTD control module harness connector and ground. If resistance is more than 500 ohms, go to step 8). If resistance is 0-500 ohms, go to next step.

7) Disconnect driver select switch. Using DVOM, measure resistance between touring switch circuit of CCR/RTD control module harness connector and ground. If resistance is 0-500 ohms, repair short in touring switch circuit. If resistance is more than 500 ohms, replace driver select switch.

8) Using DVOM, measure resistance between touring switch circuit and system ground circuit of CCR/RTD control module harness connector. If resistance is more than 500 ohms, replace CCR/RTD control module. If resistance is 0-500 ohms, repair short in touring switch circuit.

9) Using DVOM, measure resistance of perform switch circuit between CCR/RTD control module harness connector and driver select switch connector. If resistance is more than 10 ohms, repair open in perform switch circuit. If resistance is 0-10 ohms, go to next step.

10) Using DVOM, measure resistance between driver select switch ground circuit of driver select switch and ground. If resistance is more than 10 ohms, repair driver select switch ground circuit. If resistance is 0-10 ohms, replace driver select switch.

11) Using DVOM, measure resistance of touring switch circuit between CCR/RTD control module harness connector and driver select switch connector. If resistance is more than 10 ohms, repair open in touring switch circuit. If resistance is 0-10 ohms, go to next step.

12) Using DVOM, measure resistance between driver select switch ground circuit of driver select switch and ground. If resistance is more than 10 ohms, repair driver select switch ground circuit. If resistance is 0-10 ohms, replace driver select switch.

CODE 34: VEHICLE SPEED SIGNAL ERROR

1) If PCM Code 24 is set, diagnose PCM Code 24. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE section. If PCM Code 24 is not set, go to next step.

2) Disconnect CCR/RTD control module connector. Using DVOM, measure resistance of vehicle speed circuit between CCR/RTD control module harness connector and Powertrain Control Module (PCM) harness connector. If resistance is 0-2 ohms, go to next step. If resistance is more than 2 ohms, repair open in vehicle speed circuit.

3) Check for short to ground in vehicle speed circuit. Using

DVOM, measure resistance between vehicle speed circuit of CCR/RTD control module harness connector and ground. If resistance is less than 100 ohms, repair short to ground in vehicle speed circuit. If resistance is more than 100 ohms, go to next step.

4) Check for short to voltage in vehicle speed circuit. Using DVOM, measure resistance between vehicle speed circuit and system power circuit of CCR/RTD control module harness connector. If resistance is less than 100 ohms, repair short to voltage in vehicle speed circuit. If resistance is more than 100 ohms, replace CCR/RTD control module.

REMOVAL & INSTALLATION

CONTROL MODULE

Removal & Installation

Turn ignition off. Move driver's seat forward. Cut back carpet under driver's seat to expose CCR/RTD control module. Disconnect CCR/RTD control module electrical connector. Remove screws and CCR/RTD control module. To install, reverse removal procedure.

LATERAL ACCELERATOR SWITCH

Removal & Installation

Turn ignition off. Move driver's seat forward. Cut back carpet under driver's seat to expose lateral accelerator switch. Disconnect lateral accelerator switch electrical connector. Remove screws and lateral accelerator switch. To install, reverse removal procedure.

STRUT ASSEMBLY

Removal & Installation

See appropriate FRONT or REAR article.

WIRING DIAGRAMS

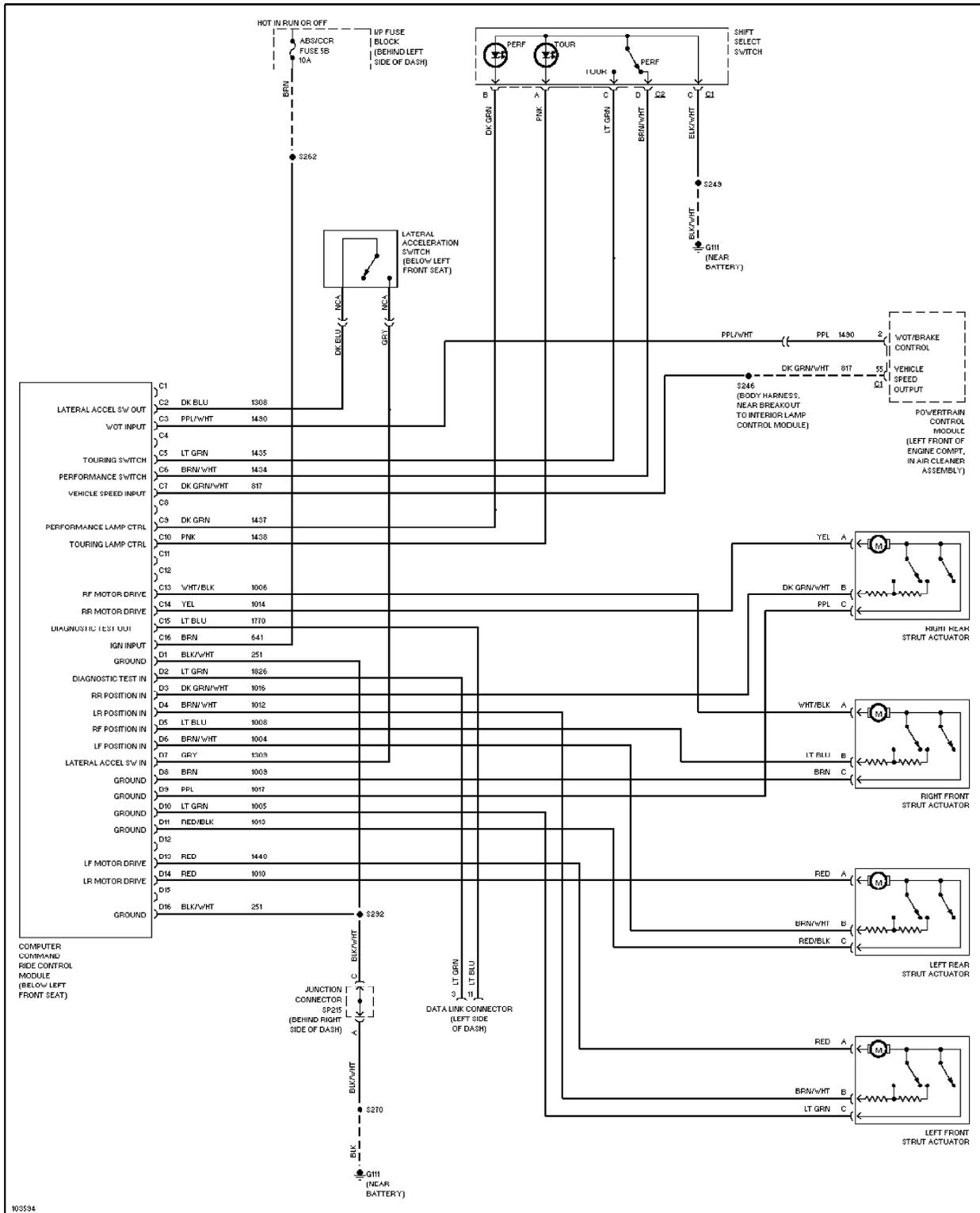


Fig. 5: Computer Command Ride/Real Time Damping) System Wiring Diagram (Bonneville - 1998)

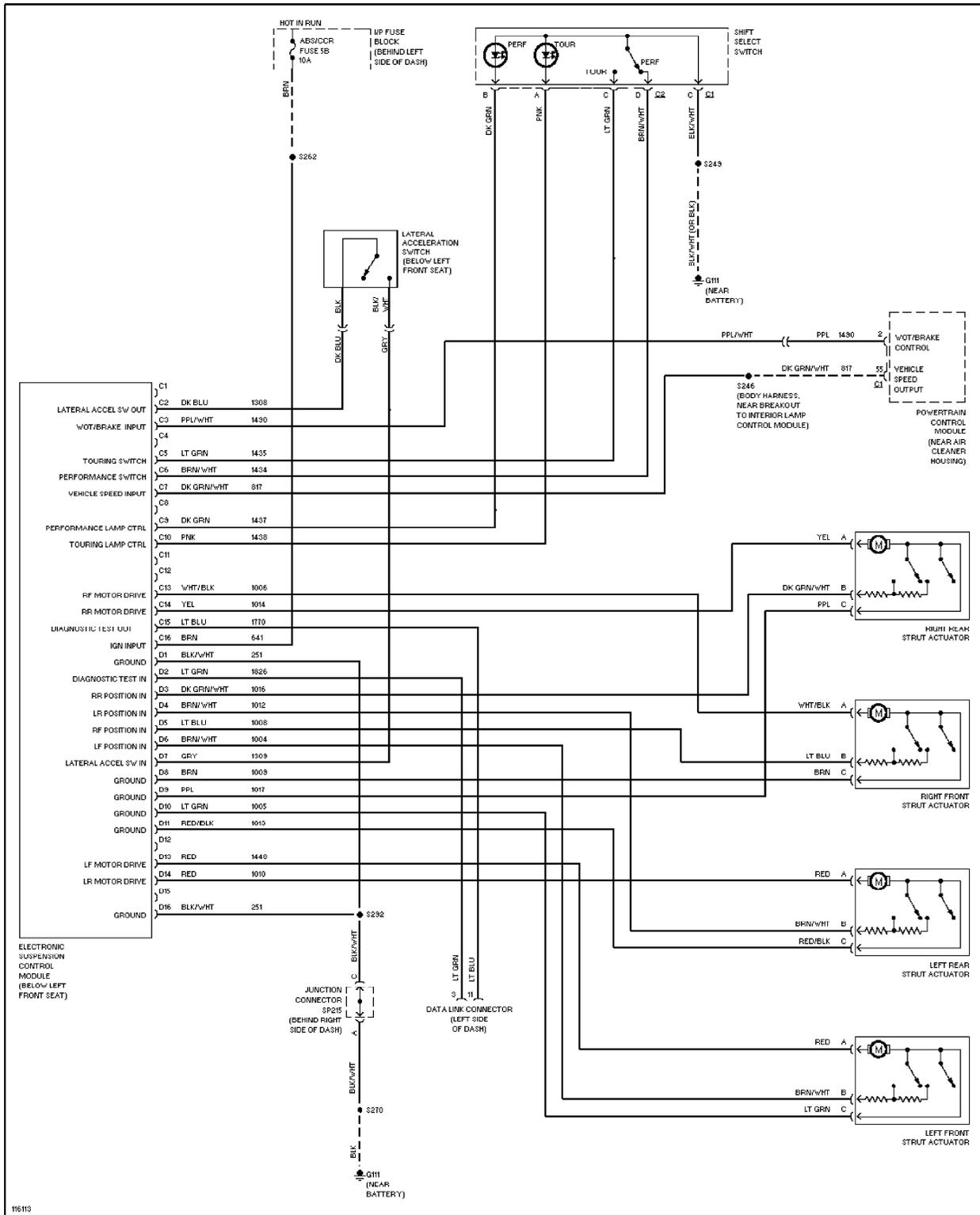


Fig. 6: Computer Command Ride/Real Time Damping (CCR/RTD) System Wiring Diagram (Bonneville - 1999)