2009 SUSPENSION

Electronic Suspension Control - Avalanche, Escalade, Tahoe & Yukon

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Air Compressor to Frame Nuts	15 N.m	11 lb ft
Air Line Tube Repair Nut	8 N.m	70 lb in
Electronic Suspension Control Module Bracket Nut	10 N.m	89 lb in
Front Position Sensor Link Bracket Bolt	9 N.m	80 lb in
Front Position Sensor Mounting Bolt	12 N.m	106 lb in
Front Suspension Position Sensor Link Ball Stud	7 N.m	62 lb in
Rear Position Sensor Link Bracket Bolt	17 N.m	13 lb ft
Rear Position Sensor Mounting Bolt	12 N.m	106 lb in

SCHEMATIC AND ROUTING DIAGRAMS

ELECTRONIC SUSPENSION CONTROL SCHEMATICS

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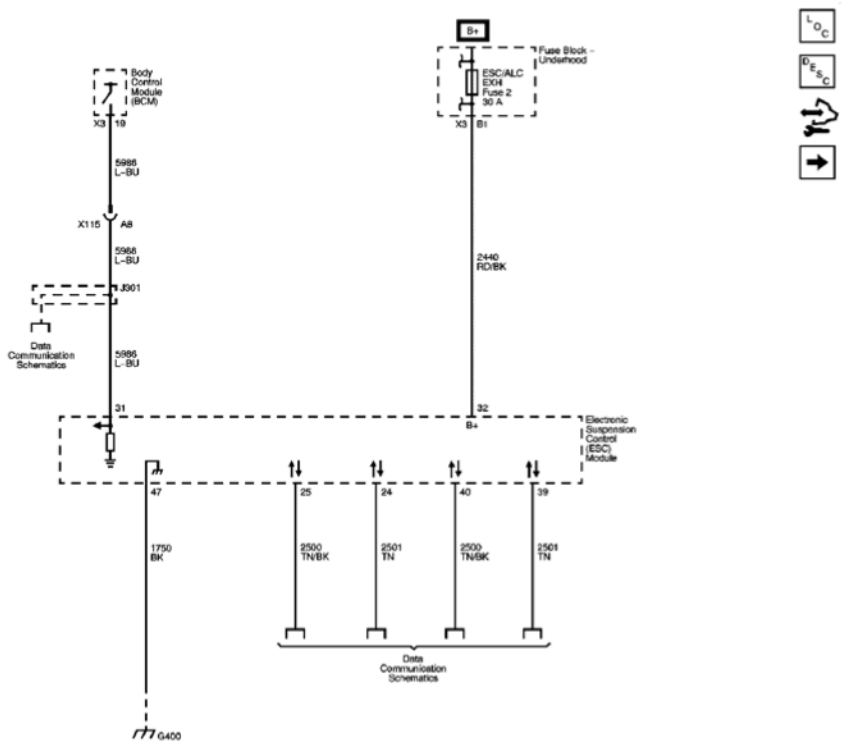

Fig. 1: Module Power, Ground, and Serial Data
Courtesy of GENERAL MOTORS CORP.

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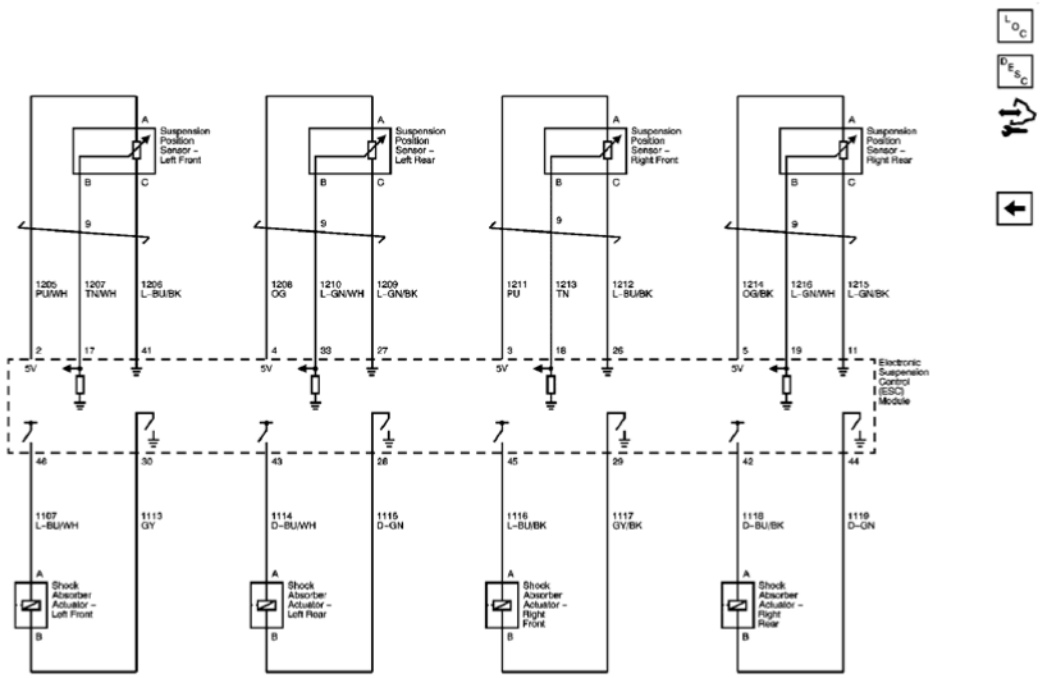

Fig. 2: Position Sensors and Solenoids
Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC C0558	C0558 00: Calibration Data Not Programmed
DTC C0575, C0580, C0585, or C0590	C0575 01: Left Front Actuator Circuit - Short To Battery C0575 02: Left Front Actuator Circuit - Short To Ground C0575 04: Left Front Actuator Circuit - Open Circuit C0580 01: Right Front Actuator Circuit - Short To Battery C0580 02: Right Front Actuator Circuit - Short To Ground C0580 04: Right Front Actuator Circuit - Open Circuit C0585 01: Left Rear Actuator Circuit - Short To Battery C0585 02: Left Rear Actuator Circuit - Short To Ground C0585 04: Left Rear Actuator Circuit - Open Circuit C0590 01: Right Rear Actuator Circuit - Short To Battery C0590 02: Right Rear Actuator Circuit - Short To Ground C0590 04: Right Rear Actuator Circuit - Open Circuit

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DTC C0615, C0620, C0625, or C0630	C0615 08: Left Front Position Sensor Circuit - Signal Invalid C0615 55: Left Front Position Sensor Circuit - Expected Number Of Transitions Not Reached C0620 08: Right Front Position Sensor Circuit - Signal Invalid C0620 55: Right Front Position Sensor Circuit - Expected Number Of Transitions Not Reached C0625 08: Left Rear Position Sensor Circuit - Signal Invalid C0625 55: Left Rear Position Sensor Circuit - Expected Number Of Transitions Not Reached C0630 08: Right Rear Position Sensor Circuit - Signal Invalid C0630 55: Right Rear Position Sensor Circuit - Expected Number Of Transitions Not Reached
DTC C0696	C0696 00: Position Sensor Overcurrent

DIAGNOSTIC STARTING POINT - ELECTRONIC SUSPENSION CONTROL

Begin the system diagnosis with **Diagnostic System Check - Vehicle (with HP2)** or **Diagnostic System Check - Vehicle (without HP2)** . The Diagnostic System Check will provide the following information:

- The identification of the control modules which command the system.
- The ability of the control modules to communicate through the serial data circuit.
- The identification of any stored diagnostic trouble codes (DTCs) and their status.

The use of the Diagnostic System Check will identify the correct procedure for diagnosing the system and where the procedure is located.

DTC C0558

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle (with HP2)** or **Diagnostic System Check - Vehicle (without HP2)** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0558 00

Calibration Data Not Programmed

Circuit/System Description

The electronic suspension control module (ESCM) performs checks of internal calibration data. If a fault condition is detected, the ESCM will set the fault DTC, and may, depending upon the fault type, turn ON the SERVICE SUSPENSION SYSTEM message. Recovery from any controller fault condition is attempted only

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after the ignition is cycled ON and OFF.

Conditions for Running the DTC

- Battery voltage is between 9-16 volts
- Ignition is ON.

Conditions for Setting the DTC

- The DTC is set when any calibration faults internal to the ESCM are detected.
- The fault is detected during 3 consecutive ignition cycles, or during the same ignition cycle after clearing the DTC with the scan tool.

Action Taken When the DTC Sets

- The ESCM disables all ALC functionality.
- The ESCM sends a message to the instrument panel cluster (IPC) to display the SERVICE SUSPENSION SYSTEM message.

Conditions for Clearing the DTC

- A current DTC will clear when the ESCM no longer senses the malfunction and the ignition is cycled ON and OFF.
- The DTC will remain in history until 50 ignition cycles have occurred.

Reference Information

Schematic Reference

Electronic Suspension Control Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Electronic Suspension Control Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Verify that DTC C0558 is not set.

- If the DTC is set, perform the **Suspension Position Calibration (Without Z95)** or **Suspension Position Calibration (With Z95)** procedure. If the DTC resets replace the ESCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for ESCM replacement, setup, and programming

DTC C0575, C0580, C0585, OR C0590

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle (with HP2)** or **Diagnostic System Check - Vehicle (without HP2)** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0575 01

Left Front Actuator Circuit - Short To Battery

DTC C0575 02

Left Front Actuator Circuit - Short To Ground

DTC C0575 04

Left Front Actuator Circuit - Open Circuit

DTC C0580 01

Right Front Actuator Circuit - Short To Battery

DTC C0580 02

Right Front Actuator Circuit - Short To Ground

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DTC C0580 04

Right Front Actuator Circuit - Open Circuit

DTC C0585 01

Left Rear Actuator Circuit - Short To Battery

DTC C0585 02

Left Rear Actuator Circuit - Short To Ground

DTC C0585 04

Left Rear Actuator Circuit - Open Circuit

DTC C0590 01

Right Rear Actuator Circuit - Short To Battery

DTC C0590 02

Right Rear Actuator Circuit - Short To Ground

DTC C0590 04

Right Rear Actuator Circuit - Open Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Suspension Damper Control Terminal A	C0575 02	C0575 04	C0575 01	-
Left Front Suspension Damper Control Terminal B	-	C0575 04	-	-
Right Front Suspension Damper Control Terminal A	C0580 02	C0580 04	C0580 01	-
Right Front Suspension Damper Control Terminal B	-	C0580 04	-	-
Left Rear Suspension Damper Control Terminal A	C0585 02	C0585 04	C0585 01	-
Left Rear Suspension Damper Control Terminal B	-	C0585 04	-	-
Right Rear Suspension Damper Control Terminal A	C0590 02	C0590 04	C0590 01	-

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Right Rear Suspension Damper Control Terminal B	-	C0590 04	-	-

Circuit/System Description

The electronic suspension control module (ESCM) commands variable levels of pulse width modulated current to each damper in response to rough road, or abrupt steering maneuver driving conditions. The ESC module continuously compares each dampers command state with the state of their feedback circuits to ensure they agree.

Conditions for Running the DTC

- Battery voltage is between 9-16 volts.
- Ignition ON for 30 seconds

Conditions for Setting the DTC

- The damper coil or the circuits to the coil are shorted to ground, shorted to voltage, or open for 3 consecutive ignition ON cycles.
- The vehicle must be driven over 4.8 km/h (3 mph).

Action Taken When the DTC Sets

- The driver information center (DIC) displays the SERVICE SUSPENSION SYSTEM message.
- If the DTC symptom 01 is stored, the ESC system is disabled.
- If the DTC symptom 02 or 04 is stored, the suspect damper is disabled.

Conditions for Clearing the DTC

- A current DTC will clear on the next consecutive malfunction-free ignition cycle.
- A history DTC will clear after 50 consecutive malfunction-free ignition cycles.

Reference Information

Schematic Reference

Electronic Suspension Control Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Electronic Suspension Control Description and Operation

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Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, with the scan tool command the damper actuators ON and OFF while jouncing the vehicle in the front and rear. The suspension should change stiffness when commanded between the ON and OFF state.

Circuit/System Testing

IMPORTANT: Whenever repairing and/or replacing ALC system components, perform the Suspension Position Calibration procedure.

1. Ignition OFF, disconnect the harness connector at the appropriate suspension damper.
2. Perform this setup step in the following order:
    1. Connect a test lamp between the damper connector control circuit terminal A and control circuit terminal B.
    2. Ignition ON, with a scan tool, clear all ESC module DTCs.
3. Command the damper ON and OFF with a scan tool. The test lamp should turn ON and OFF when changing between the commanded states.
    - If the test lamp is always ON, test the control circuit terminal A for a short to voltage. If the circuit tests normal, replace the ESC module.
    - If the test lamp is always OFF, test the control circuits listed below. If all circuits test normal, replace the ESC module.
        - Control circuit terminal A for a short to ground or open/high resistance.
        - Control circuit terminal B for an open/high resistance or short to voltage.
4. If all circuits test normal, test or replace the suspension damper.

Component Testing

1. Ignition OFF, disconnect the harness connector at the appropriate suspension damper.
2. Test for .7-3.3 ohms between the control terminal A and the low control terminal B of the suspension damper.
    - If not within the specified range, replace the suspension damper.

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Repair Procedures

- **Shock Absorber Replacement (1500)** or **Shock Absorber Replacement (2500)**
- **Suspension Position Calibration (Without Z95)** or **Suspension Position Calibration (With Z95)**
- **Control Module References** for ESCM replacement, setup, and programming

Repair Verification

1. Install any components or connectors that have been removed or replaced during diagnosis.
2. Perform any adjustment, programming or setup procedures that are required when a component or module is removed or replaced.
3. Clear the DTCs.
4. Use the scan tool Diagnostic Counter Reset output control function to bypass the 3 consecutive ignition cycle requirement for setting a DTC. This will ensure that if a DTC was to be reset during the repair verification process, it will be displayed on the scan tool.
5. Turn OFF the ignition for 60 seconds.
6. Turn ON the ignition.
7. If the repair was related to a DTC, duplicate the Conditions for Running the DTC and use the Freeze Frame/Failure Records, if appropriate, in order to verify the DTC does not reset. If the DTC resets or another DTC is present, refer to the **Diagnostic Trouble Code (DTC) List - Vehicle** and perform the appropriate diagnostic procedure

DTC C0615, C0620, C0625, OR C0630

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle (with HP2)** or **Diagnostic System Check - Vehicle (without HP2)** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0615 08

Left Front Position Sensor Circuit - Signal Invalid

DTC C0615 55

Left Front Position Sensor Circuit - Expected Number Of Transitions Not Reached

DTC C0620 08

Right Front Position Sensor Circuit - Signal Invalid

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DTC C0620 55

Right Front Position Sensor Circuit - Expected Number Of Transitions Not Reached

DTC C0625 08

Left Rear Position Sensor Circuit - Signal Invalid

DTC C0625 55

Left Rear Position Sensor Circuit - Expected Number Of Transitions Not Reached

DTC C0630 08

Right Rear Position Sensor Circuit - Signal Invalid

DTC C0630 55

Right Rear Position Sensor Circuit - Expected Number Of Transitions Not Reached

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Strut Position Sensor Low Reference Circuit	-	C0615 08	-	-
Left Front Strut Position Sensor 5 Volt Voltage Reference Circuit	C0696	C0615 08	C0696	-
Left Front Strut Position Sensor Signal Circuit	C0615 08	C0615 08	C0615 08	C0615 55
Right Front Strut Position Sensor Low Reference Circuit	-	C0620 08	-	-
Right Front Strut Position Sensor 5 Volt Voltage Reference Circuit	C0696	C0620 08	C0696	-
Righ Front Strut Position Sensor Signal Circuit	C0620 08	C0620 08	C0620 08	C0620 55
Left Rear Strut Position Sensor Low Reference Circuit	-	C0625 08	-	-
Left Rear Strut Position Sensor 5 Volt Voltage Reference Circuit	C0696	C0625 08	C0696	-
Left Rear Strut Position Sensor Signal Circuit	C0625 08	C0625 08	C0625 08	C0625 55
Right Rear Strut Position Sensor Low Reference Circuit	-	C0630 08	-	-
Right Rear Strut Position Sensor 5	C0696	C0630 08	C0696	-

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Volt Voltage Reference Circuit				
Right Rear Strut Position Sensor Signal Circuit	C0630 08	C0630 08	C0630 08	C0630 55

Circuit/System Description

The electronic suspension control (ESC) module supplies a 5 volt reference signal to each suspension position sensor. The suspension position sensors supply an voltage signal of 0.35-4.75 volts to the ESC module which represents the position between the body and the wheel. The sensors are also grounded through the ESC module.

Conditions for Running the DTC

- Battery voltage is between 9-16 volts
- Ignition is ON

Conditions for Setting the DTC

- The DTC is set when the ESC module measures a position sensor signal voltage below 0.35 volt or above 4.75 volts for more than 1 second while the vehicle is operated under normal driving conditions.
- The fault is detected during 3 consecutive ignition cycles, or during the same ignition cycle after clearing the DTC with a scan tool.

Action Taken When the DTC Sets

- The ESC will enter the speed dependent damping mode.
- Both left and right normal force outputs will be set to the default output states.
- The ESC sends a message to the instrument panel cluster (IPC) to display SERVICE SUSPENSION SYSTEM message.

Conditions for Clearing the DTC

A history DTC will clear after 50 consecutive ignition cycles if the condition for the malfunction is no longer present.

Reference Information

Schematic Reference

Electronic Suspension Control Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

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Electronic Suspension Control Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for Scan Tool Information

Circuit/System Verification

Ignition ON, observe the scan tool Position Sensor Data parameters. The readings should vary between 0.35-4.75 volts while the vehicle is jounced.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the applicable suspension position sensor.
2. Ignition OFF, test for less than 5 ohms between the low reference circuit terminal C and ground.
    - If greater than the specified range, test the low reference circuit for an open/high resistance. If circuit tests normal, replace the ESC module.
3. Ignition ON, test for 4.75-5.25 volts between the 5 volt reference circuit terminal A and ground.
    - If less than the specified range, test the 5 volt reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the ESC module.
    - If greater than the specified range, test the 5 volt reference circuit for a short to voltage. If the circuit tests normal, replace the ESC module.
4. Verify the applicable scan tool position sensor parameter is less than 0.35 volts.
    - If greater than the specified range, test the signal circuit terminal B for a short to voltage. If all circuits test normal replace the ESC module.
5. Install a 3A fused jumper wire between the signal circuit terminal B and the 5 volt reference circuit terminal A. Verify the scan tool position sensor parameter is greater than 4.75 volts.
    - If less that the specified range, test the signal circuit for a short to ground or an open high resistance. If all circuits test normal replace the ESC module.
6. If all circuits test normal, test or replace the applicable suspension position sensor.

Component Testing

1. Install a 3A fused jumper wire between the 5 volt reference terminal A and 5 volts. Install a jumper wire between the low reference terminal C and ground.
2. Sweep the suspension position sensor through the entire range while monitoring the voltage between the signal terminal B and the low reference terminal C. The range should vary between 0.35-4.75 volts

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without any spikes or dropouts.

- If not within the specified range or if it is erratic, replace the applicable suspension position sensor.

Repair Procedures

- **Electronic Suspension Front Position Sensor Replacement**
- **Electronic Suspension Rear Position Sensor Replacement - Left Side**
- **Electronic Suspension Rear Position Sensor Replacement - Right Side**
- **Suspension Position Calibration (Without Z95)** or **Suspension Position Calibration (With Z95)**
- **Control Module References** for ESC replacement, setup, and programming

Repair Verification

1. Install any components or connectors that have been removed or replaced during diagnosis.
2. Perform any adjustment, programming or setup procedures that are required when a component or module is removed or replaced.
3. Clear the DTCs.
4. Use the scan tool Diagnostic Counter Reset output control function to bypass the 3 consecutive ignition cycle requirement for setting a DTC. This will ensure that if a DTC was to be reset during the repair verification process, it will be displayed on the scan tool.
5. Turn OFF the ignition for 60 seconds.
6. Turn ON the ignition.
7. If the repair was related to a DTC, duplicate the Conditions for Running the DTC and use the Freeze Frame/Failure Records, if applicable, in order to verify the DTC does not reset. If the DTC resets or another DTC is present, refer to the **Diagnostic Trouble Code (DTC) List - Vehicle** and perform the appropriate diagnostic procedure.

DTC C0696

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle (with HP2)** or **Diagnostic System Check - Vehicle (without HP2)** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0696 00

Position Sensor Overcurrent

Diagnostic Fault Information

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Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Strut Position Sensor Low Reference Circuit	-	C0615 08	-	-
Left Front Strut Position Sensor 5 Volt Voltage Reference Circuit	C0696	C0615 08	C0696	-
Left Front Strut Position Sensor Signal Circuit	C0615 08	C0615 08	C0615 08	C0615 55
Right Front Strut Position Sensor Low Reference Circuit	-	C0620 08	-	-
Right Front Strut Position Sensor 5 Volt Voltage Reference Circuit	C0696	C0620 08	C0696	-
Right Front Strut Position Sensor Signal Circuit	C0620 08	C0620 08	C0620 08	C0620 55
Left Rear Strut Position Sensor Low Reference Circuit	-	C0625 08	-	-
Left Rear Strut Position Sensor 5 Volt Voltage Reference Circuit	C0696	C0625 08	C0696	-
Left Rear Strut Position Sensor Signal Circuit	C0625 08	C0625 08	C0625 08	C0625 55
Right Rear Strut Position Sensor Low Reference Circuit	-	C0630 08	-	-
Right Rear Strut Position Sensor 5 Volt Voltage Reference Circuit	C0696	C0630 08	C0696	-
Right Rear Strut Position Sensor Signal Circuit	C0630 08	C0630 08	C0630 08	C0630 55

Circuit/System Description

The electronic suspension control (ESC) module provides a common regulated reference voltage of approximately 5 volts to all of the position sensors. The ESC module monitors this power supply for a malfunction that could prevent it from correctly regulating the supply voltage.

Conditions for Running the DTC

- Battery voltage is between 9-16 volts
- Ignition is ON

Conditions for Setting the DTC

- The ESC module senses suspension position sensor supply voltage under 4.75 volts or over 5.25 volts.
- The condition is detected for 1 second in 4 consecutive ignition cycles.

Action Taken When the DTC Sets

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- Commands speed dependent damping system and normal force signals to the default state.
- The ESC sends a message to the instrument panel cluster (IPC) to display SERVICE SUSPENSION SYSTEM message.

Conditions for Clearing the DTC

- A history DTC will clear after 100 consecutive ignition cycles if the condition for the malfunction is no longer present.
- The ESC module senses the correct sensor supply voltage.
- The IPC clearing DTC feature.

Reference Information

Schematic Reference

Electronic Suspension Control Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Electronic Suspension Control Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for Scan Tool Information

Circuit/System Verification

Ignition ON, observe the scan tool Position Sensor Data parameters. The readings should vary between 0.35-4.75 volts while the vehicle is jounced.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at all 4 suspension position sensors.
2. Ignition ON, test for 4.75-5.25 volts between the 5 volt reference circuit terminal A and ground at each

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sensor connector.

- If less than the specified range, test the 5 volt reference circuit for a short to ground or an open/high resistance. If all circuits test normal, replace the ESC module.
- If greater than the specified range, test the 5 volt reference circuit for a short to voltage. If the circuit tests normal, replace the ESC module.

3. Reinstall each sensor, one at a time, while verifying for 4.75-5.25 volts between the 5 volt reference circuit terminal A and ground of the last sensor connector to be connected.
   - If the voltage is out of the range when one of the 3 sensors are connected, test or replace the suspect suspension position sensor.
4. Test or replace the last remaining suspect suspension position sensor.

Component Testing

1. Install a 3A fused jumper wire between the 5 volt reference terminal A and 5 volts. Install a jumper wire between the low reference terminal C and ground.
2. Sweep the suspension position sensor through the entire range while monitoring the voltage between the signal terminal B and the low reference terminal C. The range should vary between 0.35-4.75 volts without any spikes or dropouts.
   - If not within the specified range or if it is erratic, replace the applicable suspension position sensor.

Repair Procedures

- **Electronic Suspension Front Position Sensor Replacement**
- **Electronic Suspension Rear Position Sensor Replacement - Left Side**
- **Electronic Suspension Rear Position Sensor Replacement - Right Side**
- **Suspension Position Calibration (Without Z95)** or **Suspension Position Calibration (With Z95)**
- **Control Module References** for ESC module replacement, setup, and programming

Repair Verification

1. Install any components or connectors that have been removed or replaced during diagnosis.
2. Perform any adjustment, programming or setup procedures that are required when a component or module is removed or replaced.
3. Clear the DTCs.
4. Use the scan tool Diagnostic Counter Reset output control function to bypass the 3 consecutive ignition cycle requirement for setting a DTC. This will ensure that if a DTC was to be reset during the repair verification process, it will be displayed on the scan tool.
5. Turn OFF the ignition for 60 seconds.
6. Turn ON the ignition.
7. If the repair was related to a DTC, duplicate the Conditions for Running the DTC and use the Freeze Frame/Failure Records, if applicable, in order to verify the DTC does not reset. If the DTC resets or another DTC is present, refer to the **Diagnostic Trouble Code (DTC) List - Vehicle** and perform the appropriate diagnostic procedure.

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REPAIR INSTRUCTIONS

ELECTRONIC SUSPENSION CONTROL MODULE REPLACEMENT

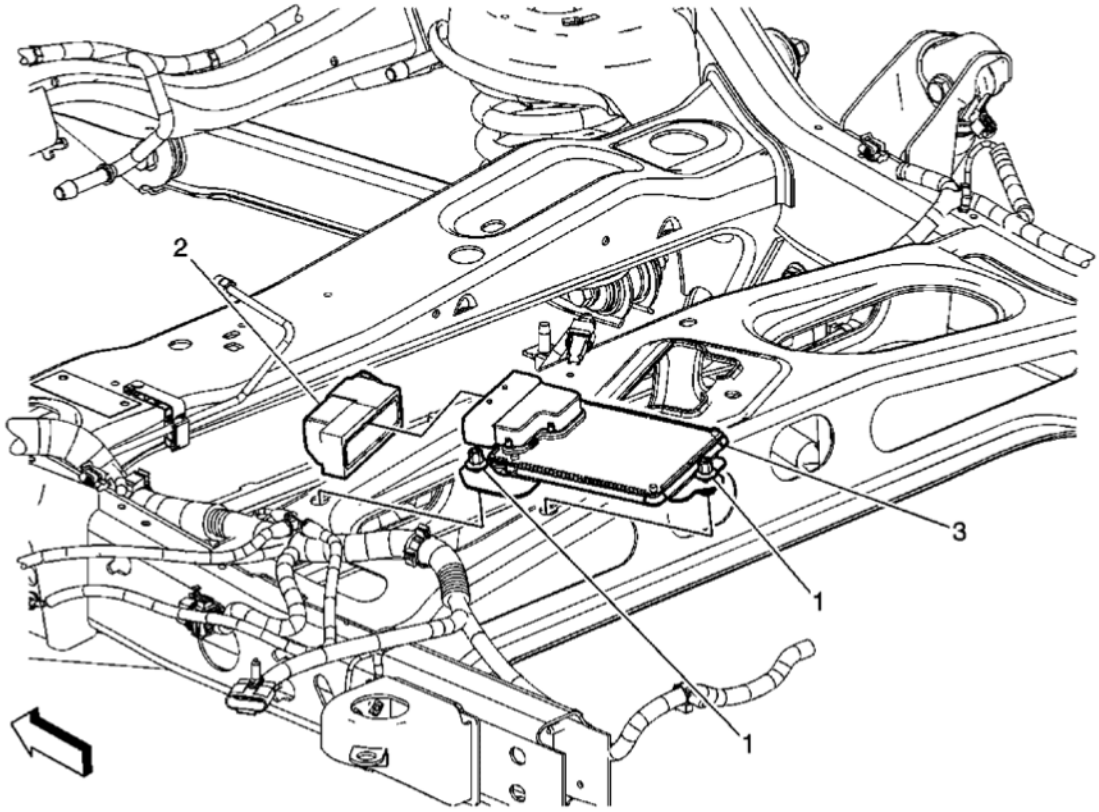

Fig. 3: View Of Electronic Suspension Control Module & Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the spare tire and wheel assembly to access the control module.	
1	Electronic Suspension Control Module Nut (Qty: 2) **CAUTION:** **Refer to Fastener Caution .** **Tip:** Loosen the module nuts. **Tighten:** 10 N.m (89 lb ft)

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2	Electronic Suspension Control Module (ESC) Connector **Tip:** Disconnect the electrical connector from the module.
3	Electronic Suspension Control (ESC) Module **Procedure** 1. Remove the ESC module from the slots in the frame. 2. Reprogram the ESC module. Refer to **Electronic Suspension Control Module Programming and Setup (Without Z95)** or **Electronic Suspension Control Module Programming and Setup (With Z95)** .

ELECTRONIC SUSPENSION FRONT POSITION SENSOR REPLACEMENT

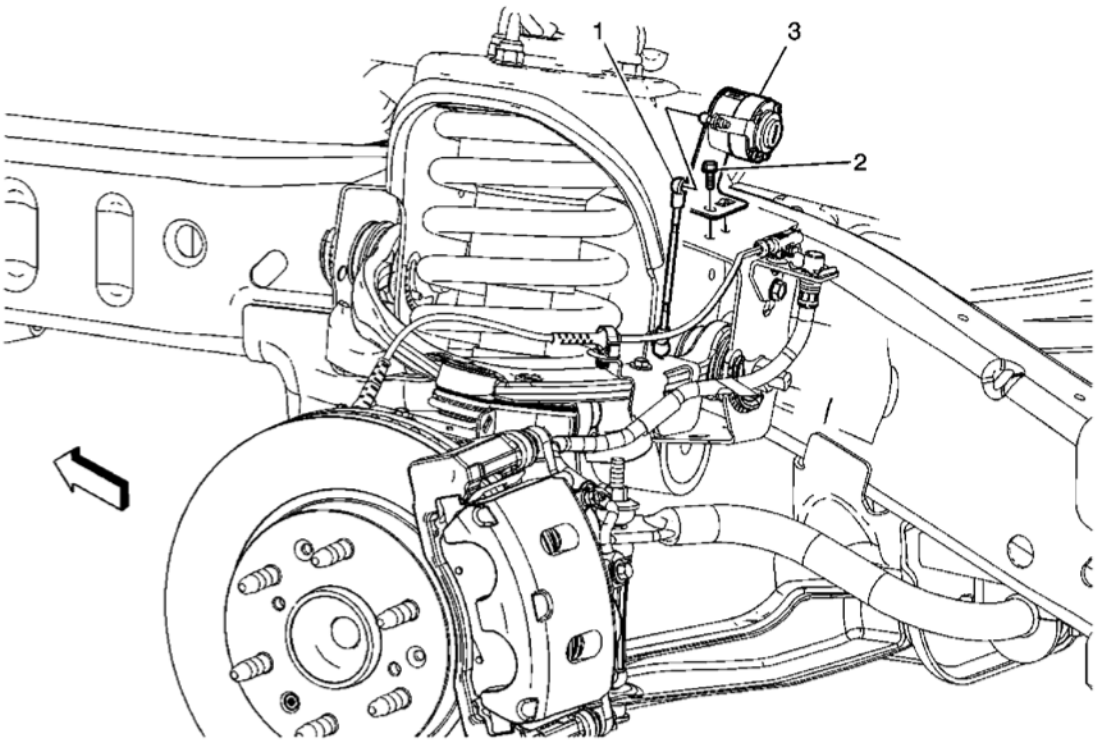

Fig. 4: View Of Front Position Sensor & Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the front tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .	
1	Front Position Sensor Link **Tip:** Disconnect the link from the sensor ball stud.

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2	Front Position Sensor Bolt **CAUTION:** **Refer to Fastener Caution .** **Tip:** Remove the bolt from the sensor. **Tighten:** 12 N.m (106 lb in)
3	Front Position Sensor **Tip:** Disconnect the electrical connector from the sensor.

ELECTRONIC SUSPENSION FRONT POSITION SENSOR LINK ASSEMBLY REPLACEMENT

Tools Required

J 38185 Spring Hose Clamp Pliers

Removal Procedure

IMPORTANT: Do not attempt to pry the link rod from the electronic suspension control (ESC) ball stud. If the link rod needs to be replaced or disconnected, you must use the following procedure.

1. Remove the ESC sensor from the vehicle. Refer to **Electronic Suspension Front Position Sensor Replacement**.
2. While supporting the sensor lever by hand, twist the link rod to remove it from the ball stud.
3. Remove the link rod from the mounting bracket ball stud.

Installation Procedure

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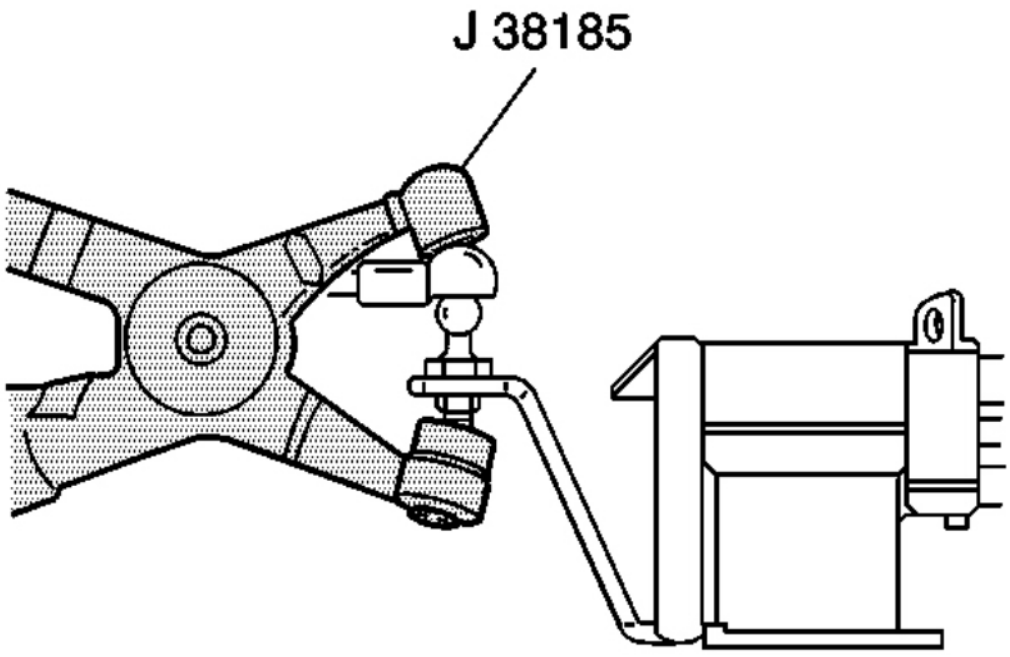

Fig. 5: Installing Link Rods To Ball Studs Using J 38185
Courtesy of GENERAL MOTORS CORP.

1. Using the **J 38185** install to link rod to the ball stud on the sensor lever and the mounting bracket.
2. Install the ESC sensor to the vehicle. Refer to **Electronic Suspension Front Position Sensor Replacement**.

ELECTRONIC SUSPENSION REAR POSITION SENSOR LINK ASSEMBLY REPLACEMENT

Tools Required

J 38185 Spring Hose Clamp Pliers

Removal Procedure

IMPORTANT: Do not attempt to pry the link rod from the electronic suspension control (ESC) ball stud. If the link rod needs to be replaced or disconnected, you must use the following procedure.

1. Remove the ESC sensor from the vehicle. Refer to **Electronic Suspension Rear Position Sensor Replacement - Left Side** or **Electronic Suspension Rear Position Sensor Replacement - Right Side**.

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2. While supporting the sensor lever by hand, twist the link rod to remove it from the ball stud.
3. Remove the link rod from the frame bracket ball stud.

Installation Procedure

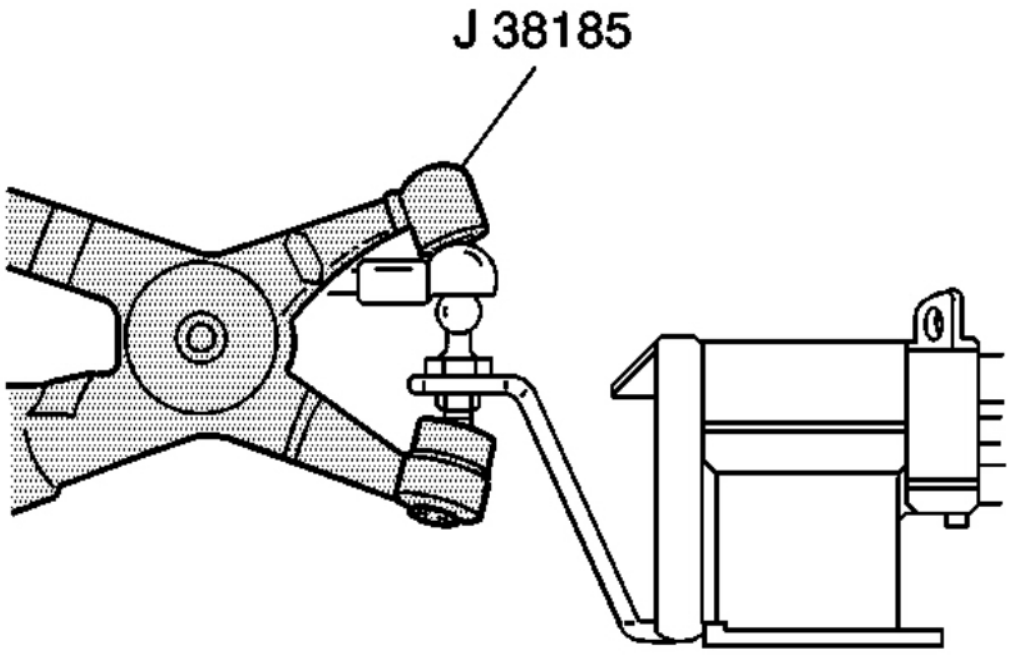

Fig. 6: Installing Link Rods To Ball Studs Using J 38185
Courtesy of GENERAL MOTORS CORP.

1. Using the **J 38185** install to link rod to the ball stud on the sensor lever and the frame bracket.
2. Install the ESC sensor to the vehicle. Refer to **Electronic Suspension Rear Position Sensor Replacement - Left Side** or **Electronic Suspension Rear Position Sensor Replacement - Right Side**.

ELECTRONIC SUSPENSION REAR POSITION SENSOR REPLACEMENT - LEFT SIDE

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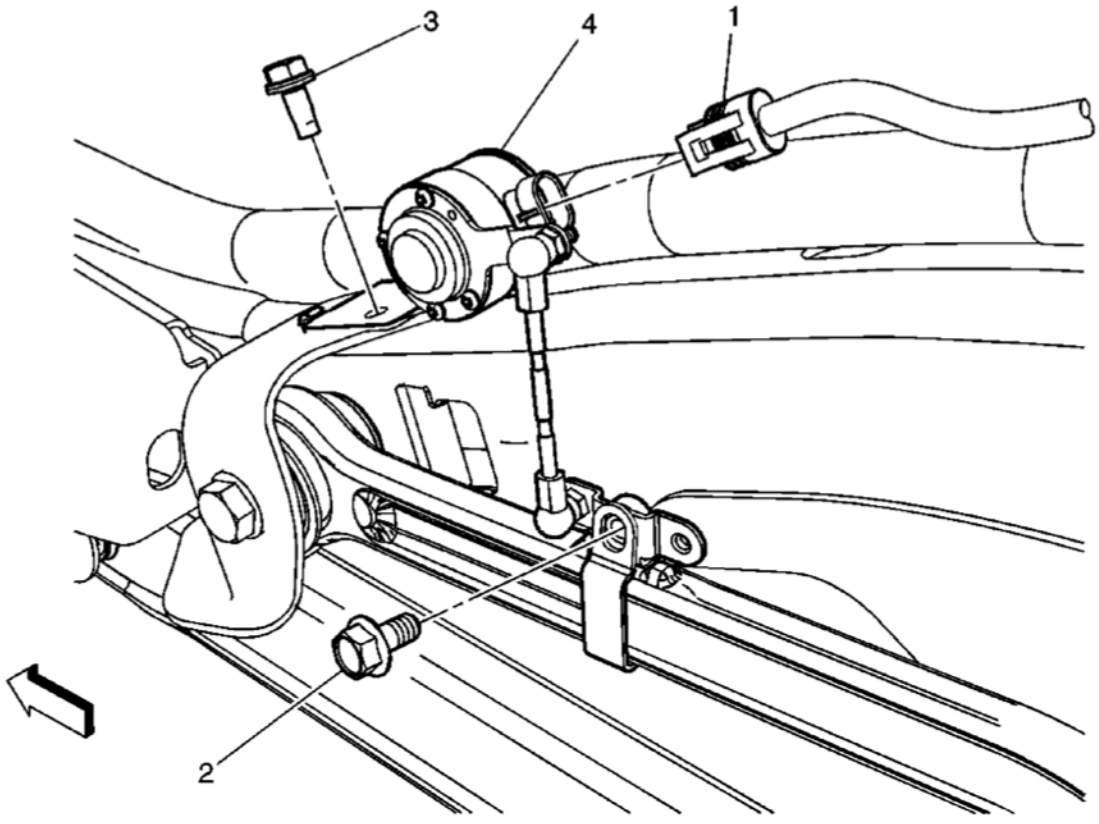

Fig. 7: View Of Electronic Suspension Position Sensor & Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the left rear tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .	
1	Electrical Connector
2	Position Sensor Servo Arm Bracket Bolt **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 17 N.m (13 lb ft)
3	Position Sensor Bracket Bolt **Tighten:** 12 N.m (106 lb in)
4	Electronic Suspension Position Sensor

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ELECTRONIC SUSPENSION REAR POSITION SENSOR REPLACEMENT - RIGHT SIDE

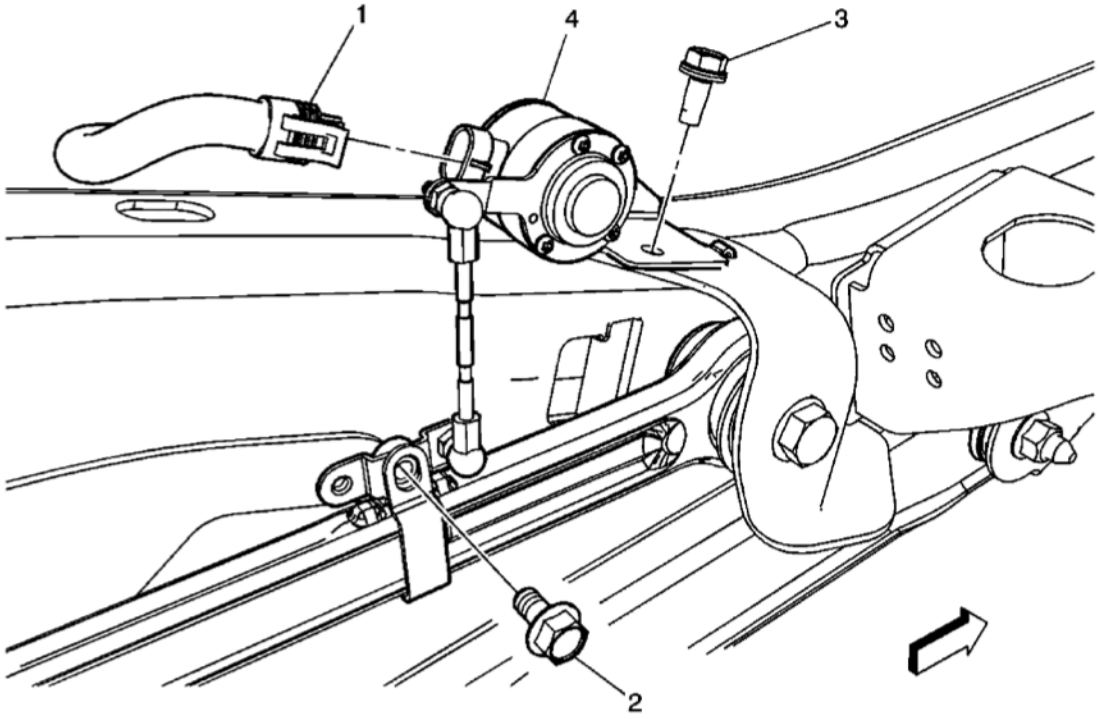

Fig. 8: View Of Electronic Suspension Position Sensor & Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the right rear tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .	
1	Electrical Connector
2	Position Sensor Servo Arm Bracket Bolt **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 17 N.m (13 lb ft)
3	Position Sensor Bracket Bolt **Tighten:** 12 N.m (106 lb in)
4	Electronic Suspension Position Sensor

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DESCRIPTION AND OPERATION

ELECTRONIC SUSPENSION CONTROL DESCRIPTION AND OPERATION

Electronic Suspension Control Description

The electronic suspension control system, also known as the magneto-rheological real time damping (MRRTD) system independently controls the fluid viscosity in each of the 4 shock absorbers in order to control the vehicle ride characteristics. The electronic suspension control (ESC) system is capable of making these changes within milliseconds. The ESC system consists of the following major components:

- The electronic suspension (ESC) module
- The front/rear position sensors
- The front/rear adjustable shock absorbers
- The shock absorber electrical actuators, which are integrated within the shock absorbers

The ESC controls the damping mode selection according to the following factors:

- The vehicle speed
- The chassis pitch input
- The steering position
- The body to wheel displacement

The ESC module evaluates these inputs in order to separately control the shock absorbers, providing an enhanced ride and comfort level over the widest possible range of operating conditions.

Electronic Suspension Control Module

The electronic suspension control (ESC) module provides electronic control logic and output drive for each shock absorber. The ESC module makes decisions due to road and driving conditions based on various inputs. The ESC module receives input information by sensors that are directly connected to the ESC module or by other systems through the serial data line and uses these inputs to independently control the shock absorbers at each corner.

Electronic Suspension Control Position Sensors

The electronic suspension control (ESC) position sensors provide the ESC module with the body to wheel displacement input. The ESC module uses this and other inputs in order to control the stiffness of the shock absorber. If any body or wheel motion is detected, the ESC module will determine how soft or firm each shock absorber should be to provide the best ride. The ESC position sensors are mounted at each corner of the vehicle between the control arm and the body/frame.

Electronic Suspension Control Shock Absorber or Strut

The electronic suspension control (ESC) shock absorbers are monotube type which provide damping by increasing magnetic flux to magnetic particles to resist suspension movement. The ESC shock absorber has the

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capability of providing multiple modes or values of damping forces, in both compression and rebound direction. The damping forces are achieved by increasing or decreasing the magnetic flux to shock absorbers.

The front ESC actuator connector is located at the top of the shock absorber. The rear ESC actuator connector is at the top of the shock absorber.

Electronic Suspension Control Operation

The electronic suspension control (ESC) system uses the information from other systems in order to execute certain functions.

The ESC system does not have a malfunction indicator lamp, but instead uses the instrument panel cluster (IPC) for the display functions. When the ESC system detects a malfunction that sets a DTC, the ESC system sends a message on the serial data line directly or through the powertrain control module (PCM) to the IPC, which will display one of the following messages:

- SHOCKS INOPERATIVE
- SERVICE SUSPENSION SYSTEM
- SPEED LIMITED

The SHOCKS INOPERATIVE message will only be displayed if the ESC system detects a malfunction that sets a DTC and causes the ESC system to disable all 4 shock absorbers. The ESC system will send a message on the serial data line to the IPC to display this message.

The SERVICE SUSPENSION SYSTEM message will only be displayed if the ESC system detects any malfunction that sets a DTC. The ESC system will send a message on the serial data line to the IPC to display this message.

The SPEED LIMITED message will only be displayed if the ESC system detects a malfunction that sets a DTC and causes the ESC system to disable all 4 shock absorbers. The ESC system will send a message on the serial data line to the PCM indicating that all 4 shock absorbers were disabled. The PCM then sends a message to the IPC to display this message.

The ESC module has the ability to store DTCs as current or history codes. Most ESC system malfunctions will display a message in the IPC and set a DTC. The message will remain ON until the RESET button is pressed on the driver information center (DIC). As long as the DTC is current, the message will be displayed after every ignition cycle and the RESET button must be pressed to bypass the message.

The ESC system uses an ignition cycling diagnostic approach in order to reduce the occurrence of false or intermittent DTCs that do not affect the functionality of the ESC system. This allows for the fail-soft actions to be taken whenever a malfunction condition is current, but requires the malfunction to be current for a certain number of ignition cycles before the corresponding malfunction code and message will be stored or displayed.

If the ESC detects a malfunction, the ESC system defaults with a fail-soft action. A fail-soft action refers to any specific action the ESC system takes in order to compensate for a detected malfunction. A typical ESC fail-soft action would be if the ESC system detects a malfunction with a shock absorber.

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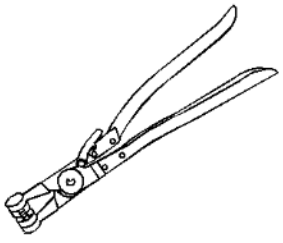
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description
	J 38185 Hose Clamp Pliers

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