Variable Effort Steering - Corvette

SCHEMATIC AND ROUTING DIAGRAMS

STEERING CONTROLS SCHEMATICS

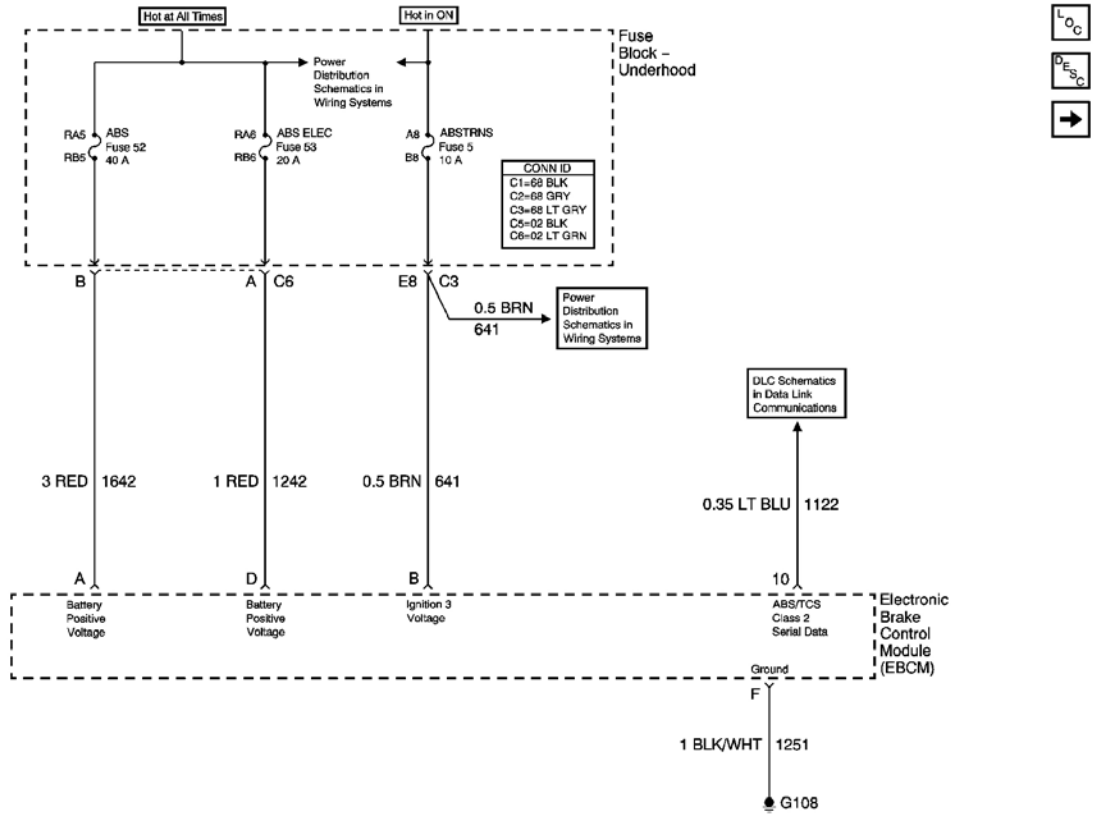


Fig. 1: Power, Ground, And DLC Schematics
Courtesy of GENERAL MOTORS CORP.

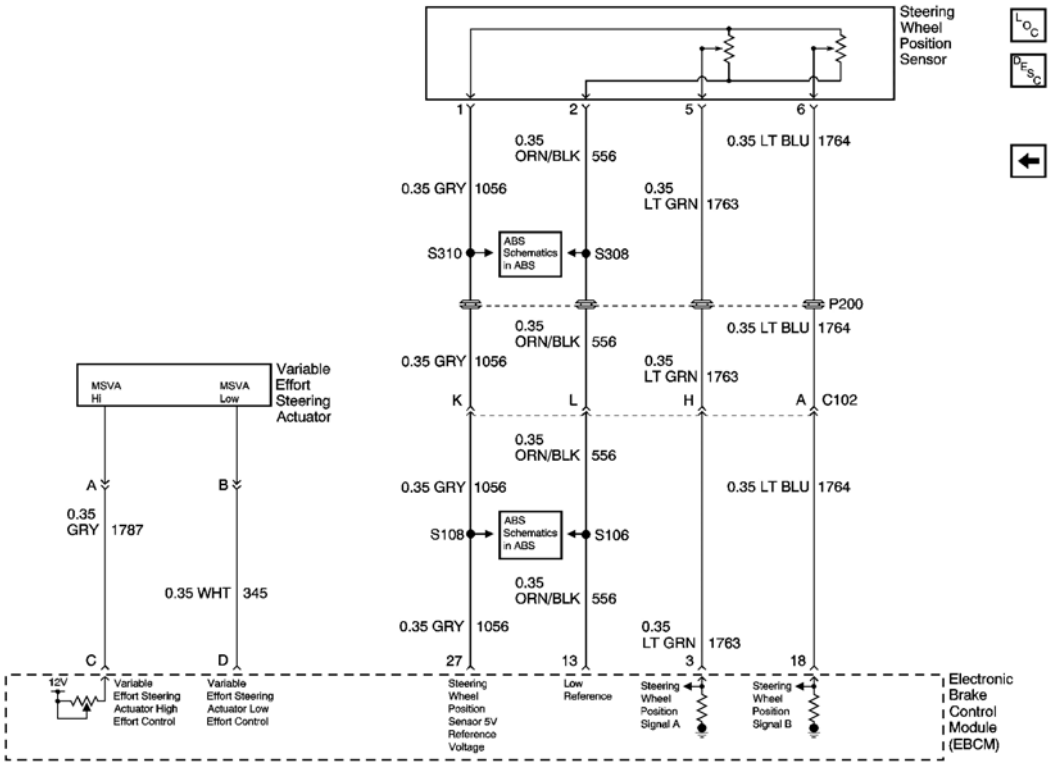


Fig. 2: Steering Wheel Position Sensor Schematics
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

STEERING CONTROLS COMPONENT VIEWS

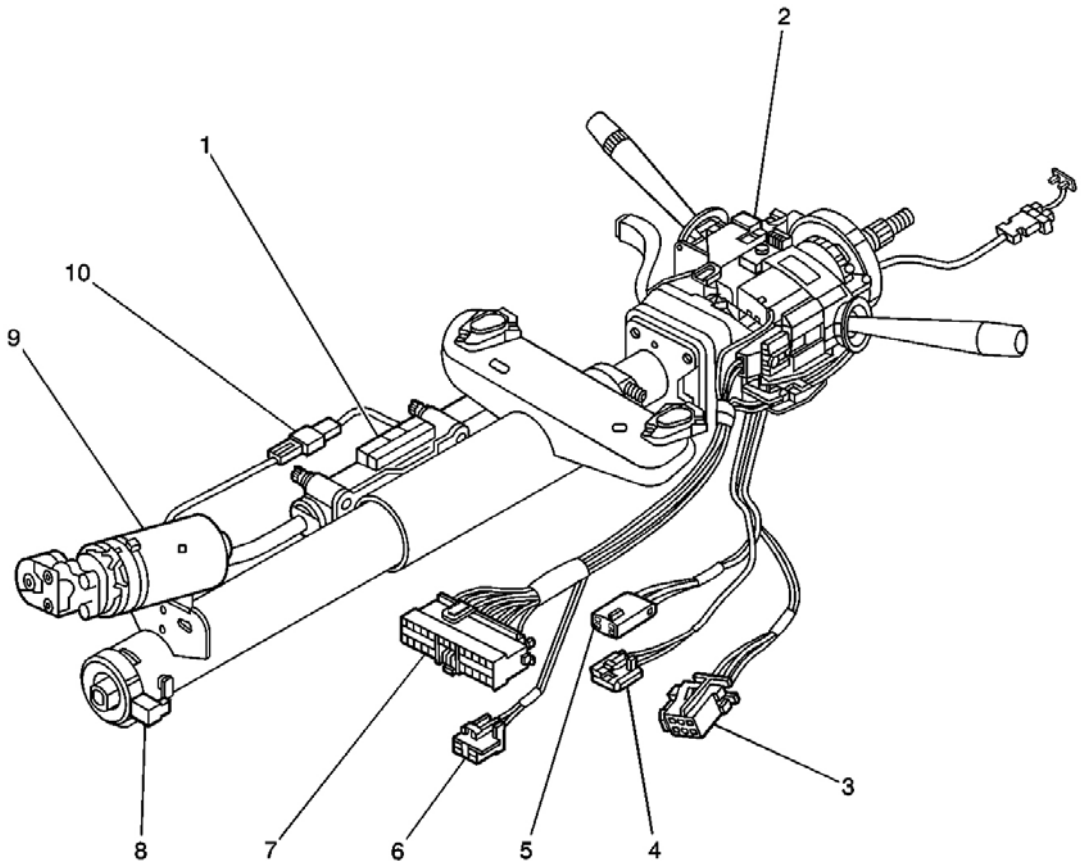


Fig. 3: Steering Column Component View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 3

Callout	Component Name
1	Telescoping Sensor
2	Steering Column Lock
3	C219
4	C207
5	C211
6	C217
7	C209
8	Steering Wheel Position Sensor
9	Telescoping Drive Motor
10	C210

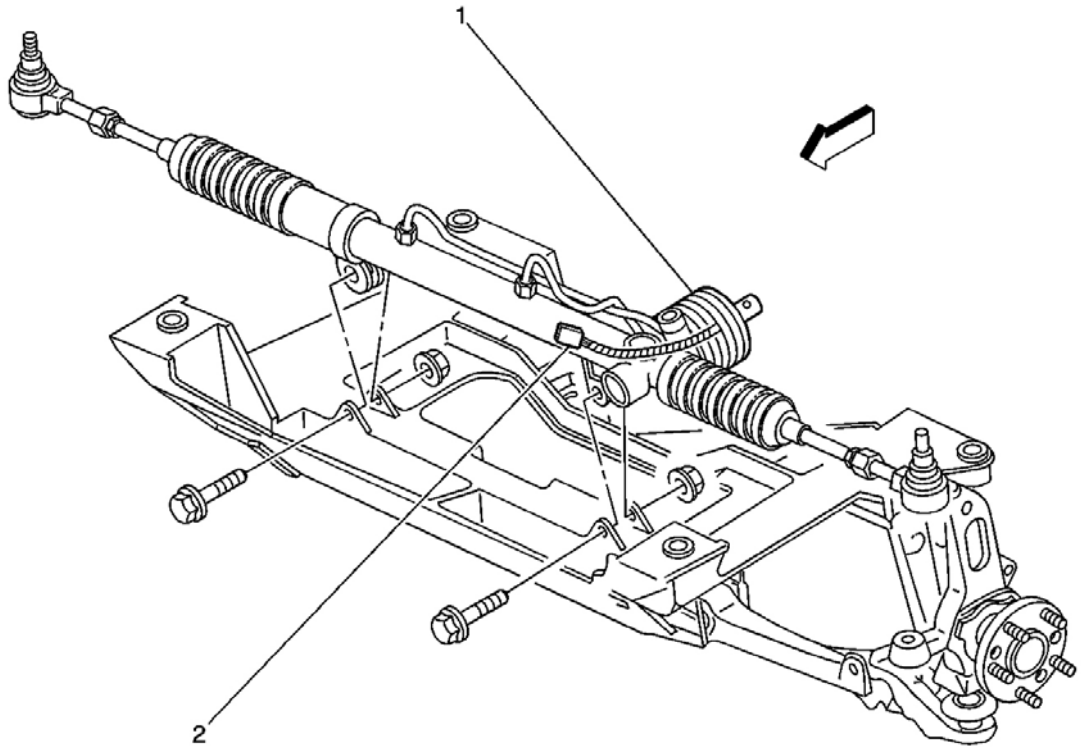


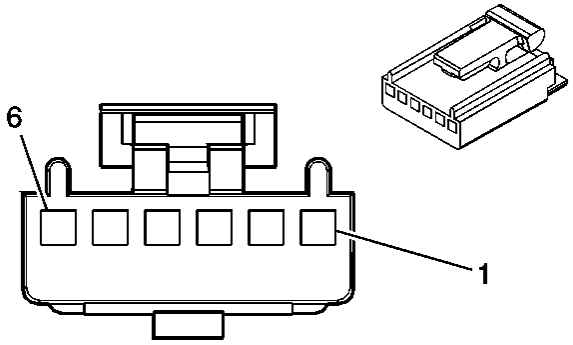
Fig. 4: Lower Front Of The Vehicle Component View
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 4

Callout	Component Name
1	Variable Effort Steering Actuator
2	Variable Effort Steering Actuator Connector

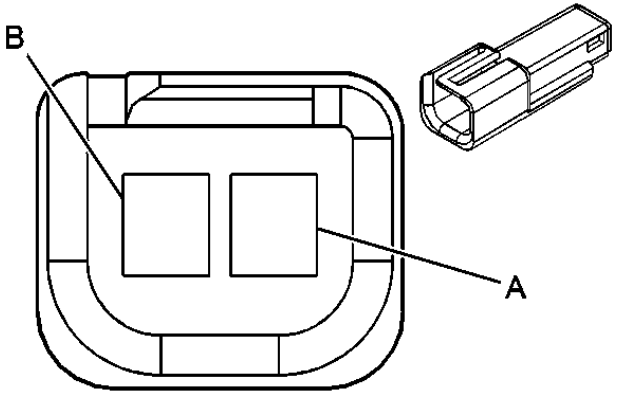
STEERING CONTROLS CONNECTOR END VIEWS

Steering Wheel Position Sensor Terminal Identification



Connector Part Information		• 1206 4978 • 6-Way F Micro-Pack 100 Series (GRY)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	GRY	1056	Steering Wheel Position Sensor 5V Reference Voltage
2	ORN/BLK	556	Low Reference
3-4	-	-	Not Used
5	LT GRN	1763	Steering Wheel Position Signal A
6	LT BLU	1764	Steering Wheel Position Signal B

Variable Effort Steering Actuator Terminal Identification



Connector Part Information		• 12052635 • 2-Way F Metri-Pack 150 Series (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	GRY	1787	Variable Effort Steering Actuator High Effort Control

B	WHT	345	Variable Effort Steering Actuator Low Effort Control

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - VARIABLE EFFORT STEERING

Begin the system diagnosis with the **Diagnostic System Check - Variable Effort Steering** . The Diagnostic System Check will provide the following information:

- The identification of the control module(s) which command the system.
- The ability of the control module(s) 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.

DIAGNOSTIC SYSTEM CHECK - VARIABLE EFFORT STEERING

Diagnostic System Check - Variable Effort Steering

Step	Action	Yes	No
1	Install a scan tool. Does the scan tool power up?	Go to **Step 2**	Go to **Scan Tool Does Not Power Up** in Data Link Communications
2	1. Turn ON the ignition, with the engine OFF. 2. Using the scan tool, attempt to establish communications with the Electronic Brake Control Module (EBCM). Does the scan tool communicate with the EBCM?	Go to **Step 3**	Go to **Scan Tool Does Not Communicate with Class 2 Device** in Data Link Communications
3	Select the display DTC function on the scan tool. Does the scan tool display any ABS, TCS or VSES DTCs?	Go to **Diagnostic System Check - ABS** in Antilock Brake System	Go to **Step 4**
4	Select the Magna Steer display DTC function on the scan tool. Does the scan tool display DTC C1241?	Go to **DTC C1241**	Go to **Symptoms - Power Steering System** in Power Steering System

SCAN TOOL DATA LIST

Electronic Brake Control Module (EBCM)

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value

Ignition ON/ Engine ON.			
Ignition Voltage	VES Data	Volts	14.65
Left Front Wheel Speed	VES Data	km/h or mph	0
Left Rear Wheel Speed	VES Data	km/h or mph	0
Right Front Wheel Speed	VES Data	km/h or mph	0
Right Rear Wheel Speed	VES Data	km/h or mph	0
Switched System Battery Voltage	VES Data	Volts	14.65
VES Commanded Current	VES Data	amps	-1.99
VES Failed	VES Data	Yes/No	No
VES Feedback Current	VES Data	amps	1.99
VES Indicator/Message	VES Data	ON/Off	Off

SCAN TOOL DATA DEFINITIONS

Ignition Voltage

The scan tool displays 0-17 volts. The amount of ignition voltage at the EBCM.

Left Front Wheel Speed

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the left front wheel.

Left Rear Wheel Speed

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the left rear wheel.

Right Front Wheel Speed

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the right front wheel.

Right Rear Wheel Speed

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the right rear wheel.

Switched System Battery Voltage

The scan tool 0-17 volts. The level of internal EBCM voltage available to the VES actuator when the ABS relay is energized.

VES Commanded Current

The scan tool displays -2.00 to 3.00 amps. The amount of current the EBCM is commanding to the VES actuator.

VES Failed

The scan tool displays Yes or No. Yes indicates a malfunction has been detected within the VES system. No indicates the VES system is operating to specification.

VES Feedback Current

The scan tool displays 2.00 to 3.00 amps. The absolute, or positive value of current returning from the VES actuator to the EBCM. Thus the - symbol is not displayed.

VES Indicator/Message

The scan tool indicates ON or Off. The state of the VES malfunction indicator or message, if equipped.

DIAGNOSTIC TROUBLE CODE (DTC) LIST

Diagnostic Trouble Code (DTC) List

DTC	Diagnostic Procedure	Module(s)
C1241	**DTC C1241**	EBCM

DTC C1241

Circuit Description

The variable effort steering (VES) system uses the electronic brake control module (EBCM) to control current to a bi-directional electromagnetic rotary actuator. The EBCM commands current from negative 2 amps to positive 3 amps to the actuator. At low speeds, a negative current is commanded, which assists steering. At medium speeds, no current is commanded and steering is assisted by hydraulics only. At high speeds, a positive current is commanded, which creates steering resistance.

Conditions for running the DTC

- Ignition voltage between 10.5 and 17 volts
- Off state test - Initial ignition ON, no engine rpm or vehicle speed present.
- On state test - If off state test passes, engine rpm and vehicle speed present.

Conditions for Setting the DTC

An open, short to ground, or short to voltage in the VES actuator or the circuits to the actuator.

Action Taken When the DTC Sets

- A DTC C1241 is stored in memory.
- The DIC may display the SERVICE STEERING SYS warning message.
- The VES system is disabled.

Conditions for Clearing the DTC

- A current DTC will clear when malfunction is no longer present.
- A history DTC will clear after 100 consecutive ignition cycles with no malfunction present.
- Using the scan tool.

Diagnostic Aids

The vehicle needs to be driven to view full commanded and feedback current ranges on the scan tool.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: Tests if the Commanded and Feedback Current parameters are at the specified value in there active state.

3: Tests if the resistance of the VES actuator is in the specified range.

7: Tests the high effort control circuit for an open or short to voltage.

8: Tests the low effort control circuit for a short to ground.

10: Tests for poor connections at the VES actuator harness connector.

13: Perform the setup procedure after EBCM replacement.

DTC C1241

Step	Action	Value (s)	Yes	No
Schematic Reference:Steering Controls Schematics **Connector End View Reference:Steering Controls Connector End Views**				
1	Did you perform the Variable Effort Steering Diagnostic System Check?	-	Go to **Step 2**	Go to **Diagnostic System Check - Variable Effort Steering**
2	1. Install a scan tool. 2. Start the engine. 3. With the scan tool, observe the Magna Steer Commanded Current and the Magna Steer Feedback Current Data parameters in the Magna Steer data list. Does the scan tool indicate that the Magna Steer Commanded and Magna Steer Feedback Current parameters are within .05 amps of each other and within specified range?	-1.84 to -1.99 A	Go to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems	Go to **Step 3**

3	1. Turn OFF the ignition. 2. Disconnect the VES actuator harness connector. 3. Measure the resistance of the VES actuator. Does the resistance measure within the specified range?	1.6-3.1 ohm	Go to **Step 4**	Go to **Step 10**
4	Test the VES actuator and actuator harness for a short to ground. Refer to **Testing for Short to Ground** and to **Wiring Repairs** in Wiring Systems. Was a short to ground located?	-	Go to **Step 5**	Go to **Step 6**
5	Visually inspect the actuator harness for any cut, chaffed or damaged wires. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 12**
6	Test the high effort control circuit of the VES actuator for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 7**
7	Test the high effort control circuit of the VES actuator for an open or short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 8**
8	Test the low effort control circuit of the VES actuator for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 9**
9	Test the low effort control circuit of the VES actuator for an open or short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 11**
10	Inspect for poor connections at the harness connector of the VES actuator. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 12**
11	Inspect for poor connections at the harness connector of the EBCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 13**
12	Replace the VES actuator. Refer to **Power Steering Gear Replacement** in Power Steering System. Did you complete the repair?	-	Go to **Step 14**	-

13	**IMPORTANT:** **Perform the setup procedure for the EBCM. An unprogrammed EBCM will result in the following conditions:** • **Inoperative, or poorly functioning DRP/ABS/TCS/VSES/VES/TPM system, if equipped.** • **Set DTC C1248** • **Set DTC C1255** Replace the EBCM. Refer to **Electronic Brake Control Module Replacement** in Antilock Brake System.Did you complete the repair?	-	Go to **Step 14**	-
14	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to **Step 2**	System OK

DESCRIPTION AND OPERATION

VARIABLE EFFORT STEERING SYSTEM DESCRIPTION AND OPERATION

The Variable Effort Steering (VES) system, or MAGNASTEER II(R) varies the amount of effort required to steer the vehicle as vehicle speed changes or lateral acceleration occurs. At low speeds, the system provides minimal steering effort for easy turning and parking maneuvers. At high speeds, the system provides firmer steering (road feel) and directional stability. When the system senses lateral acceleration, steering becomes firmer to reduce oversteering. The Electronic Brake Control Module (EBCM) controls a bi-directional magnetic rotary actuator located in the steering rack and pinion. The EBCM varies the steering assist by adjusting the current flow through the actuator. The actuator adjusts the amount of power steering assist to achieve a given level of effort to steer the vehicle. The VES system accomplishes this by adding or subtracting torque on the input shaft to the rack and pinion. The main component of the system is an electromagnetic actuator, which consists of a multiple-pole ring-style permanent magnet, a pole piece, and an electromagnetic coil assembly. The VES system uses the Antilock Brake System (ABS) wheel speed sensor inputs to determine vehicle speed. When the EBCM senses vehicle speed, it commands a current to the actuator that is most appropriate for each speed. The system also uses inputs such as Handwheel position, wheelbase, understeer coefficient and steering ratio to calculate lateral acceleration. The EBCM commands current from negative two amps to positive three amps to the actuator, which is polarized. At low speeds, a negative current is commanded, which assists steering. At medium speeds, no current is commanded and steering is assisted by hydraulics only. At high speeds, a positive current is commanded, which creates steering resistance. Ignition voltage and ground are provided through the EBCM. The EBCM has the ability to detect malfunctions in the actuator or the circuitry to the actuator. Any malfunctions detected will cause the system to ramp to zero amps and steering will be assisted by hydraulics only.