

## **DTC C0472 OR C0473**

### **Circuit Description**

The steering wheel position sensor (SWPS) provides one analog signal and 3 digital signals. The digital signals, Phase A, Phase B and marker pulse, are direct inputs to the rear wheel steering control module. The analog signal is input to the body control module (BCM) and is sent via a class 2 message to the rear wheel steering control module. Battery voltage is supplied to the sensor from the cruise fuse to operate the digital portion of the sensor.

A 12-volt reference is provided by the rear wheel steering control module to the Phase A, Phase B, and marker pulse circuits of the SWPS. The module monitors each circuit as it is either remains high or is pulled low by the SWPS

The scan tool displays the Phase A and Phase B Data parameters as either HIGH or LOW when the steering wheel is being rotated. Each change from HIGH to LOW, or LOW to HIGH, represents one degree of steering wheel rotation. When observing the Phase A and Phase B data with the scan tool, the parameters will not always display the same value at the same time.

The marker pulse is a digital pulse signal that is displayed as HIGH by the scan tool with the steering wheel angle between +10 degrees and -10 degrees. At greater than 10 degrees steering wheel angle in either direction, the marker pulse data will be displayed as LOW.

The BCM provides the 5-volt reference and low reference for the analog portion of the SWPS. The BCM reads the SWPS analog signal in voltage, which is typically 2.5 volts with the steering wheel on center. The voltage ranges from 0.25 volt at approximately one full turn left to 4.75 volts at approximately one full turn right. The voltage will then remain at that level for the remainder of steering wheel travel. This voltage can be monitored in BCM data display.

The rear wheel steering control module receives the analog signal via a class 2 message from the BCM. When monitoring the rear wheel steering data, this information is displayed in the Steering Wheel Angle (TBC) Data parameter, and is shown in degrees. The range of the display is +/- 225 degrees, with negative numbers representing steering input to the left, and positive numbers representing input to the right.

### **DTC Descriptors**

This diagnostic procedure supports the following DTCs:

- DTC C0472 Steering Position and Rate of Change Sensor Circuit Low
- DTC C0473 Steering Position and Rate of Change Sensor Circuit High

### **Conditions for Running the DTC**

The ignition is ON.

### **Conditions for Setting the DTC**

The BCM detects that the analog steering signal circuit is an open, shorted to ground or shorted to voltage.

### **Action Taken When the DTC Sets**

The BCM sends a serial data message reporting the failed steering signal.

### Conditions for Clearing the DTC

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

### Diagnostic Aids

Thoroughly inspect connections or circuitry that may cause an intermittent malfunction. Refer to **Testing for Electrical Intermittents** , **Testing for Intermittent Conditions and Poor Connections** , **Wiring Repairs** and **Connector Repairs** in Wiring Systems.

### Test Description

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

**4:** This step checks the 5-volt reference and signal circuits. It also checks the ability of the BCM to read the signal circuit.

**5:** This step checks the integrity of the low reference circuit.

**10:** This step tests for excessive voltage on the 5-volt reference circuit.

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Step	Action	Values	Yes	No
<b>Schematic Reference: <u>Body Control System Schematics</u></b> in Computer/Integrating Systems <b>Connector End View Reference: <u>Rear Wheel Steering Connector End Views</u></b>				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to <b>Step 2</b>	Go to <b><u>Diagnostic System Check - Vehicle</u></b> in Vehicle DTC Information
2	1. Clear the DTC with a scan tool. 2. Start the engine. 3. With the engine running, turn the steering wheel back and forth from lock to lock.  Does the DTC reset?	-	Go to <b>Step 3</b>	Go to Diagnostic Aids

3	<ol style="list-style-type: none"> <li>1. Turn the ignition OFF.</li> <li>2. Disconnect the steering wheel position sensor (SWPS) harness connector.</li> <li>3. Turn the ignition ON.</li> <li>4. Select the Body Control Module Data List on the scan tool.</li> <li>5. Observe the Analog SWPS Signal parameter on the scan tool.</li> </ol> <p>Does the scan tool indicate that the Steering Wheel Position Sensor Data parameter is less than specified value?</p>	0.15 V	-	-
4	<ol style="list-style-type: none"> <li>1. Connect a 3-amp fused jumper wire between the steering wheel position 5-volt reference circuit and the analog steering signal circuit.</li> <li>2. Observe the Analog SWPS Signal parameter on the scan tool.</li> </ol> <p>Does the scan tool indicate that the Steering Wheel Position Sensor Data parameter is greater than specified value?</p>	4.75 V		
5	<p>Use a DMM to measure the voltage between the steering wheel position 5-volt reference circuit and the steering wheel position low reference circuit.</p> <p>Does the voltage measure greater than the specified value?</p>	4.75 V		
6	<p>Test the 5-volt reference circuit of the SWPS for an open or short to ground. Refer to <b><u>Circuit Testing</u></b> and <b><u>Wiring Repairs</u></b> in Wiring Systems. Did you find and correct the condition?</p>	-	Go to <b>Step 15</b>	Go to <b>Step 7</b>
7	<p>Test the signal circuit of the SWPS for an open or a short to ground. Refer to <b><u>Testing for Short to Ground</u></b> and <b><u>Wiring Repairs</u></b> in Wiring Systems. Did you find and correct the condition?</p>	-	Go to <b>Step 15</b>	Go to <b>Step 12</b>
8	<p>Test the low reference circuit of the SWPS for an open. Refer to <b><u>Circuit Testing</u></b> and <b><u>Wiring Repairs</u></b> in Wiring Systems. Did you find and correct the condition?</p>	-	Go to <b>Step 15</b>	Go to <b>Step 12</b>
9	<p>Test the signal circuit of the SWPS for a short to voltage. Refer to <b><u>Circuit Testing</u></b> and <b><u>Wiring Repairs</u></b> in Wiring Systems. Did you find and correct the condition?</p>	-	Go to <b>Step 15</b>	Go to <b>Step 14</b>

10	Test the 5-volt reference circuit of the SWPS for a short to voltage. Refer to <b><u>Circuit Testing</u></b> and <b><u>Wiring Repairs</u></b> in Wiring Systems. Did you find and correct the condition?	-	Go to <b>Step 15</b>	Go to <b>Step 11</b>
11	Inspect for poor connections at the harness connector of the SWPS. Refer to <b><u>Testing for Intermittent Conditions and Poor Connections</u></b> and <b><u>Connector Repairs</u></b> in Wiring Systems. Did you find and correct the condition?	-	Go to <b>Step 15</b>	Go to <b>Step 13</b>
12	Inspect for poor connections at the harness connector of the body control module (BCM). Refer to <b><u>Testing for Intermittent Conditions and Poor Connections</u></b> and <b><u>Connector Repairs</u></b> in Wiring Systems. Did you find and correct the condition?	-	Go to <b>Step 15</b>	Go to <b>Step 14</b>
13	<b>IMPORTANT:</b> <b>Perform the learn alignment procedure. Refer to <u>Measuring Wheel Alignment (w/Rear Wheel Steering)</u> or <u>Measuring Wheel Alignment (w/o Rear Wheel Steering)</u> .</b>  Replace the SWPS. Refer to <b><u>Steering Wheel Position Sensor or Steering Shaft Lower Bearing Replacement</u></b> in Steering Wheel and Column. Did you complete the replacement?	-	Go to <b>Step 15</b>	-
14	Replace the BCM. Refer to <b><u>Control Module References</u></b> in Computer/Integrating Systems for replacement, setup, and programming. Did you complete the replacement?	-	Go to <b>Step 15</b>	-
15	1. Clear the DTCs with the scan tool. 2. Operate the vehicle within the conditions for running the DTC as specified in the supporting text.  Does the DTC reset?	-	Go to <b>Step 2</b>	System OK