

ACCESSORIES & EQUIPMENT Active

Noise Cancellation - CTS Sedan

SCHEMATIC WIRING DIAGRAMS

ACTIVE NOISE CANCELLATION WIRING SCHEMATICS

Active Noise Cancellation System

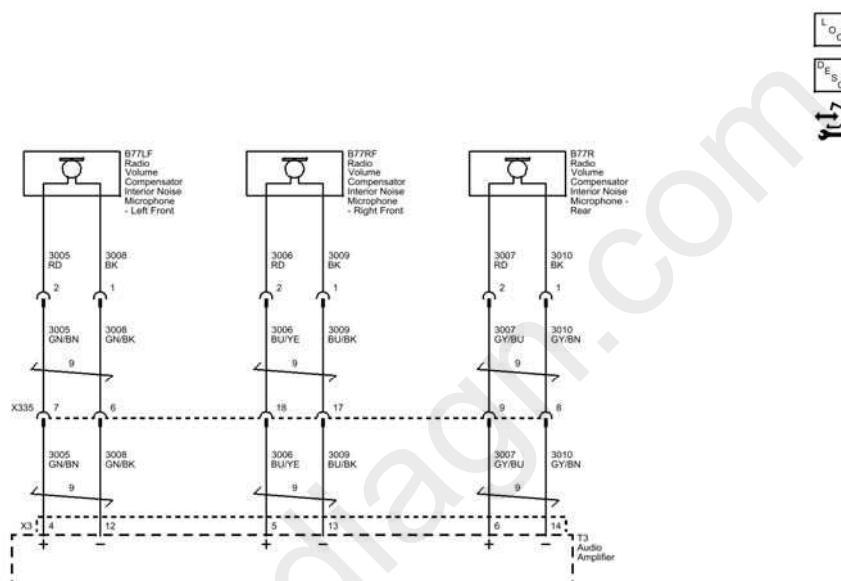


Fig. 1: Active Noise Cancellation System
Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
<u>DTC B0560</u>	DTC B0560 08 Engine RPM Input Circuit Signal Invalid
<u>DTC B1277, B127C, or B127D</u>	DTC B1277 Microphone 1 Input Signal Circuit DTC B127C Microphone 2 Input Signal Circuit

DTC B0560: ENGINE RPM INPUT CIRCUIT SIGNAL INVALID**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** 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 B0560 08**

Engine RPM Input Circuit Signal Invalid

Circuit/System Description

The Audio Amplifier receives a discrete pulse-width modulated engine speed signal from the Engine Control Module. The Audio Amplifier uses the engine RPM signal for operating active noise cancellation.

Conditions for Running the DTC

- Engine running, Radio ON
- Battery voltage between 9-16 volts.

Conditions for Setting the DTC

- The Audio Amplifier receives a serial data message that the engine is running.
- The discrete engine speed signal to the Audio Amplifier indicates the engine speed is less than 300 RPM or greater than 9000 RPM.

Action Taken When the DTC Sets

The active noise cancellation system is disabled.

Conditions for Clearing the DTC

- A current DTC clears when a valid engine speed signal between 300-9000 RPM is received.
- A history DTC clears when the ignition cycle counter reaches the reset threshold without a repeat of the malfunction.

Reference Information

Schematic Reference

Active Noise Cancellation Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX - SEDAN

Description and Operation

Active Noise Cancellation 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 Testing

NOTE: Diagnose any Engine Control Module DTCs before performing this diagnostic.

1. Ignition OFF, disconnect the X3 harness connector at the T3 Audio Amplifier.
2. Engine running at 600 RPM,
3. Test for 575-625 Hz AC between the signal circuit terminal 2 and ground.
 - **If not between 575-625 Hz AC**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module. Ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Ignition OFF.
 4. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 5. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K20 Engine Control Module.
 - **If between 575-625 Hz AC**
4. Test or replace the T3 Audio Amplifier.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

Control Module References for Audio Amplifier or Engine Control Module replacement, programming, and setup.

DTC B1277, B127C, OR B127D: MICROPHONE INPUT SIGNAL CIRCUIT

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provide an overview of each diagnostic category.

DTC Descriptors

DTC B1277

Microphone 1 Input Signal Circuit

DTC B127C

Microphone 2 Input Signal Circuit

DTC B127D

Microphone 3 Input Signal Circuit

For symptom byte information refer to **Symptom Byte List**

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Microphone High Signal Circuit (LF)	B1277 02	B1277 04	B1277 1A	-
Microphone Low Signal Circuit (LF)	B1277 02	B1277 04	B1277 1A	-
Microphone High Signal Circuit (RF)	B127C 02	B127C 04	B127C 1A	-
Microphone Low Signal Circuit (RF)	B127C 02	B127C 04	B127C 1A	-
Microphone High Signal Circuit (RR)	B127D 02	B127D 04	B127D 1A	-
Microphone Low Signal Circuit	B127D 02	B127D 04	B127D 1A	-

(RR)				
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Circuit/System Description

The active noise cancellation system uses three microphones in the vehicle headliner: one above each front seating position, and one above the rear seat. The Audio Amplifier provides a bias voltage to each microphone (+) and (-) signal circuits for operation of the microphone. The microphones monitor the vehicle cabin for undesirable engine sounds. The Audio Amplifier uses the microphone inputs and an engine RPM signal to determine the frequency of the undesirable sound.

Conditions for Running the DTC

The Audio Amplifier performs a self diagnostic of the microphone circuits 16 seconds after initial power up, then periodically every 400 milliseconds thereafter.

Conditions for Setting the DTC

DTC B1277 01, B127C 01, B127D 01

- DTC B1325 is not current
- A short to voltage is detected on the specified (+) or (-) signal circuit for more than 1.5 seconds

DTC B1277 02, B127C 02, B127D 02

- DTC B1325 is not current
- A short to ground is detected on the specified (+) or (-) signal circuit for more than 1.5 seconds

DTC B1277 04, B127C 04, B127D 04

- DTC B1325 is not current
- An open is detected on the specified (+) or (-) signal circuit for more than 1.5 seconds

DTC B1277 1A, B127C 1A, B127D 1A

- DTC B1325 is not current
- An out of range voltage is detected on the specified (+) or (-) signal circuit for more than 1.5 seconds

Action Taken When the DTC Sets

The active noise cancellation system is disabled.

Conditions for Clearing the DTC

- A current DTC clears when the self diagnostic passes on the next ignition cycle.
- A history DTC clears when the ignition cycle counter reaches the reset threshold without a repeat of the malfunction.

Diagnostic Aids

- Installation of aftermarket replacement speakers, additional speakers/subwoofers, or aftermarket exhaust systems can cause undesirable behavior of the active noise cancellation system.
- The noise reduction microphones have foam blocks above them to seal the microphones and aid in the reduction of headliner vibration. Missing or out of place foam blocks can impact system performance.

Reference Information

Schematic Reference

Active Noise Cancellation Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX - SEDAN

Description and Operation

Active Noise Cancellation 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 Testing

1. Ignition OFF, disconnect the harness connector at the appropriate B77 Radio Volume Compensator Interior Noise Microphone. Ignition ON radio ON.
2. Test for 7.8-8.8 V between the signal circuit terminal 2 and ground.
 - **If less than 7.8 V**
 1. Ignition OFF, disconnect the X3 harness connector at the T3 Audio Amplifier.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.

- If less than 2 ohms, replace the T3 Audio Amplifier.
- **If greater than 8.8 V**
 1. Ignition OFF, disconnect the X3 harness connector at the T3 Audio Amplifier. Ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the T3 Audio Amplifier.
 - **If between 7.8-8.8 V**
- 3. Test for less than 1 V between the signal circuit terminal 1 and ground.
 - **If greater than 1 V**
 1. Ignition OFF, X3 harness connector at the T3 Audio Amplifier. Ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V, replace the T3 Audio Amplifier.
 - **If less than 1 V**
- 4. Ignition OFF, disconnect the X3 harness connector at the T3 Audio Amplifier.
- 5. Test for infinite resistance between the B77 Radio Volume Compensator Interior Noise Microphone signal circuit terminal 1 and ground.
 - **If less than infinite resistance**

Repair the short to ground in the circuit
 - **If infinite resistance**
- 6. Test for less than 2 ohms in the signal circuit end to end.
 - **If 2 ohms or greater**

Repair the open/high resistance in the circuit
 - **If less than 2 ohms**
- 7. Replace the B77 Radio Volume Compensator Interior Noise Microphone.
- 8. Ignition ON
- 9. Verify the DTC does NOT set.
 - **If the DTC sets**

Replace the T3 Audio Amplifier
 - **If the DTC does not set**
- 10. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- **Radio Volume Compensator Interior Noise Microphone Replacement**
- **Control Module References** for Audio Amplifier replacement, programming, and setup.

DESCRIPTION AND OPERATION

ACTIVE NOISE CANCELLATION DESCRIPTION AND OPERATION

The entertainment system on this vehicle may have several different configurations. To determine the specific configuration of the vehicle, please see the Service Parts ID Label, and refer to **RPO Code List** .

Active Noise Cancellation Block Diagram

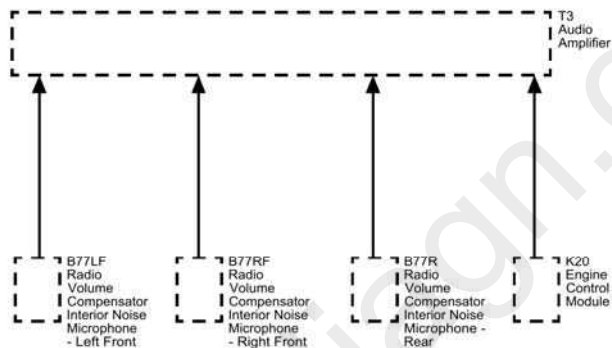


Fig. 2: Active Noise Cancellation Block Diagram
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
HW	Hard-Wired
HW	Hard-Wired
HW	Hard-Wired
HW	Hard-Wired
T3	T3 Audio Amplifier
B77LF	B77LF Radio Volume Compensator Interior Noise Microphone - Left Front
B77RF	B77RF Radio Volume Compensator Interior Noise Microphone - Right Front

B77R	B77R Radio Volume Compensator Interior Noise Microphone - Rear
K20	K20 Engine Control Module

The main components of the Active Noise Cancellation system are:

- 3 microphones in the vehicle headliner.
- A discrete engine speed (RPM) signal from the engine control module to the amplifier
- Active Noise Cancellation electronics and software integrated into the audio amplifier
- The vehicle speaker system, connected to the amplifier, to output the desired cancellation frequencies

The Active Noise Cancellation system is operational under the following conditions:

- The amplifier has passed all self diagnostic checks
- All doors are closed
- Battery voltage is between 9.5 V and 16 V
- The vehicle cabin temperature is less than 140°F (60°C)
- Engine speed is between 550 and 3000 RPM

The Active Noise Cancellation system is a method used to reduce the perception of certain undesirable sounds generated by the engine into the vehicle cabin. The system uses microphone and engine speed signals, software integrated into the amplifier, and the vehicle speakers to determine and generate the correct frequencies needed to achieve the desired reduction.

Three microphones are located in the headliner to monitor noise/sounds in the vehicle cabin, and are directly connected to the amplifier. The amplifier also receives a discrete engine speed (RPM) signal from the engine control module. The amplifier processes these inputs to determine the frequency of the undesirable sound. The amplifier then calculates the appropriate cancellation frequency and outputs a cancellation signal (audio tone) to the vehicle speakers to reduce the perception of undesirable sounds by the vehicle occupants so the vehicle cabin appears quieter and without vibration.