

GENERIC · POWERTRAIN

P2221

OBD-II DIAGNOSTIC TROUBLE CODE (DTC)

P2221

NOx Sensor Heater Sense Circuit (Bank 2 Sensor 1)

P2221 indicates that the powertrain control module has detected an abnormal condition in the heater sense circuit for the nitrogen oxide sensor on bank 2 sensor 1, which is the upstream sensor on the bank of cylinders that does not contain cylinder one. The computer monitors the heater element's electrical feedback to confirm the sensor reaches operating temperature quickly enough for accurate emissions control, and this code sets when the sensed voltage or current falls outside the expected range.

SYSTEM Powertrain	CODE TYPE Generic (all makes)	SEVERITY Medium	FIX DIFFICULTY Intermediate	AREA Fuel and air metering (injector circuits)
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Symptoms you may notice

- Illumination of the check engine light, often with no other noticeable symptoms
- Slightly reduced fuel economy as the engine management system adjusts for unavailable NOx readings
- Intermittent hesitation or rough running during cold starts while the sensor heater is commanded on
- A pending or stored emissions-related fault that prevents the vehicle from passing an inspection
- In rare cases, a noticeable delay in the sensor becoming active, leading to poor emissions performance

Common causes, most likely first

- 1 Failed heater element inside the bank 2 sensor 1 NOx sensor assembly
- 2 Damaged or corroded wiring harness between the sensor and the control module
- 3 Loose, backed-out, or contaminated electrical connector pins at the sensor or module
- 4 Blown fuse or relay supplying power to the NOx sensor heater circuit
- 5 Internal fault in the powertrain control module driver circuit for the heater sense line
- 6 Exhaust system leaks or excessive soot buildup affecting sensor heater performance
- 7 Aftermarket or incorrect sensor installed that does not meet the heater resistance specification



How to diagnose and fix it

- 1 Connect a scan tool and record all stored and pending codes, then verify the P2221 is current and not a history code from a previous repair
- 2 Inspect the bank 2 sensor 1 NOx sensor connector and harness for corrosion, chafing, or loose pins, and repair any damage found
- 3 Check the heater circuit fuse and relay, and test for battery voltage at the sensor heater supply with the key on
- 4 Measure the heater element resistance at the sensor connector and compare it to the manufacturer's specification to confirm an open or shorted heater
- 5 Perform a voltage drop test on the heater sense circuit while commanding the heater on with a scan tool to identify excessive resistance in the wiring
- 6 If the circuit tests good, substitute a known-good NOx sensor and clear the code to see if it returns
- 7 If the code persists after sensor replacement, diagnose the control module driver circuit and reprogram or replace the module only as a last resort

What the heater sense circuit really monitors

- The heater sense circuit does not measure exhaust gas; it only confirms the heater element is drawing the expected current, so a sensor that reads NOx perfectly can still set P2221 if its heater is failing.
- A common misdiagnosis is replacing the NOx sensor when the real fault is a corroded ground connection for the heater circuit, which causes a voltage drop that mimics a failed heater.
- Bank 2 sensor 1 is often the upstream sensor on the bank without cylinder one, and on V6 or V8 engines this location can be difficult to access, leading to damaged connectors during unrelated repairs.
- Some vehicles set P2221 after a battery replacement or low-voltage event because the module loses its learned heater resistance values, and the code may clear after a few drive cycles without any parts replaced.
- Exhaust leaks upstream of the sensor can allow condensation to reach the heater element and cause intermittent heater circuit faults that do not appear during a cold resistance test.

Can I keep driving with P2221?

The vehicle remains safe to drive because the fault affects emissions control rather than immediate engine operation, but prolonged driving with a failed heater can lead to increased NOx emissions and eventual damage to the sensor. Avoid extended idling and schedule diagnosis soon, especially if an emissions inspection is due.

Tools that help

- OBD-II scan tool with live data and bidirectional control capability
- Digital multimeter with resistance and voltage drop functions
- Wiring diagram and connector pinout for the specific vehicle
- Socket set and trim removal tools for sensor access
- Fuse puller and test light



Reading P2221

- P** Powertrain: engine, transmission and emissions.
- 2** Generic (SAE) code: it means the same thing on every OBD-II vehicle.
- 2** Fuel and air metering (injector circuits).
- 21** The exact fault within that area.

Often seen with

P2200 NOx Sensor Circuit (Bank 1 Sensor 1) · **P2201** NOx Sensor Circuit Range/Performance (Bank 1 Sensor 1) · **P2220** NOx Sensor Heater Control Circuit High (Bank 2 Sensor 1) · **P2222** NOx Sensor Heater Sense Circuit Range/Performance (Bank 2 Se · **P229E** NOx Sensor Circuit (Bank 1 Sensor 2)

See it working

Watch the animated explainer [How a Fuel Injector Works: Pulse Width and Spray](#) on Auto Veteran to see the parts involved moving.

Full guide, related articles and animations: <https://www.autoveteran.tech/dtc-codes/p2221/>

