

# System Diagnosis

Proper vehicle diagnosis requires a plan before you start

*Following a set procedure to base your troubleshooting on will help you find the root cause of a problem and prevent unnecessary repeat repairs .*

**STEP ONE:** Understand the Customer's Concern

Information collection beyond the basics.

Questions asked MUST be related To the system you will be working on and the customer complaint

**STEP TWO:** Check for Technical Service Bulletins

Every vehicle that comes into the shop for a repair (not necessary for routine maintenance) should be checked for TSB's , This can save you hours of troubleshooting.

**STEP THREE:** Conduct a Systematic Diagnosis

*This step will be different for every system*

Follow the troubleshooting steps for the system you are working on.

Make sure to check EVERY component of the system and that they are in proper working order.

Document your diagnosis including tests and results.

**STEP FOUR:** Complete and Confirm the Repair

Make sure you have taken care of the customers concerns.

Try to duplicate the conditions that were present when the vehicle failed

**DENSO**

# O2 sensor VS Air Fuel ratio Sensor

Oxygen Sensor bases have many holes



Air/Fuel Sensor bases have fewer holes



How to find sensor type information on the Vehicle

This label shows either A/FS\* or HO2S (or O2S)



\* Note: Air/Fuel sensors are before the catalytic converter

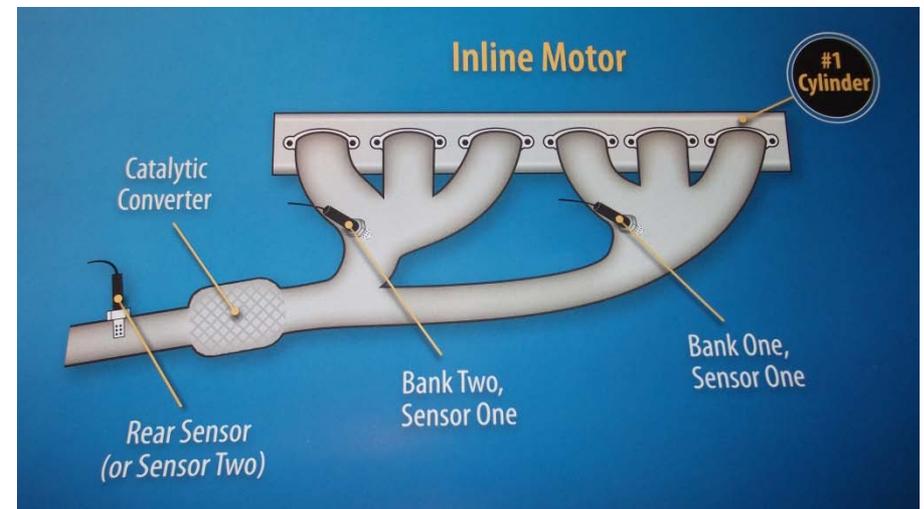
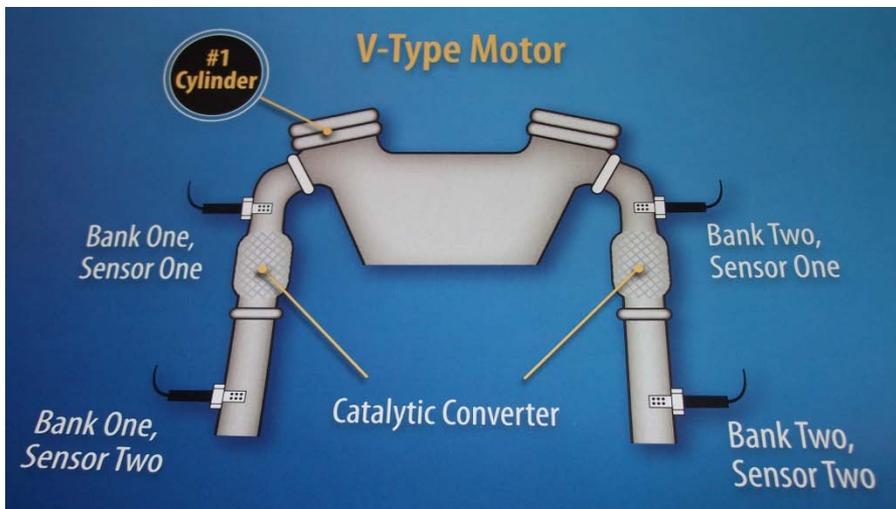
# Sensor Location

## #1 Cylinder is the key to locating the Oxygen Sensor

To locate bank one / sensor one, the key is to identify the # 1 engine cylinder.

In a V-type motor, sensor one (s) are in the exhaust system before the catalytic converter.

In an inline motor, the rear sensor (or sensor two) is in the exhaust system after the catalytic converter.



# O2 Sensor

## Check the voltage signal

Using a 10-megaohm digital voltmeter Hook up the voltmeter's red probe to the sensor's signal wire and the black probe to engine ground. **(use back probe method, DO NOT pierce the wire)**

- 1) Start the engine and let it idle for about two minutes while watching the digital reading on the voltmeter.  
It should be fixed for a short period at around 0.1 or 0.2 volts.
- 2) After two or three minutes, the voltage reading will begin to fluctuate between 0.1 and 0.9 volts.  
If the sensor takes four minutes or more to begin fluctuating, replace it.
- 3) Record the lowest and highest voltage reading from the voltmeter in any one-minute period.  
The voltage should fluctuate constantly between 0.1 and 0.9 volts.
- 4) Replace the oxygen sensor if the voltage:
  - Goes above this range,
  - Remains below 0.5 volts
  - Stays fixed at a particular voltage
- 5) Open and close the engine throttle with a quick motion.  
The sensor's output voltage should go up and down accordingly.



# Data Interpretation

## • O2 Sensor voltage

The O2 sensor normally alternates between 0 V and 1 V. When the value is fixed (stuck) at either 1 V or 0 V, investigate the cause of richness or leanness.

Fixed at 1V	Fixed at 0V
Inspect whether something is causing a rich air-fuel ratio (see list below) If there are no abnormalities found replace the O2 sensor	Inspect whether something is causing a lean air-fuel ratio (see list below) If there are no abnormalities found replace the O2 sensor

### Possible causes of a Rich Condition

Plugged air filter	Faulty ECU
Faulty air mass meter	Faulty MAP sensor
Faulty idle control valve	Faulty fuel pressure regulator
Faulty fuel injectors	Restricted fuel return line
Fouled spark plugs	Faulty ignition wires
Ignition timing	Faulty oxygen sensor
Faulty air fuel sensor	Faulty EVAP
Associated wiring	Engine coolant temperature

### Possible causes of a Lean Condition

Vacuum leak	Faulty ECU
Faulty air mass meter	Faulty air flow meter
Faulty MAP sensor	Faulty idle control valve
Faulty fuel pressure regulator	Faulty fuel pump
Restricted fuel filter	Faulty fuel injectors
Faulty PCV	Associated wiring
Exhaust gas leak	Faulty oxygen sensor
Faulty air fuel sensor	Ignition timing
EGR valve	



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