

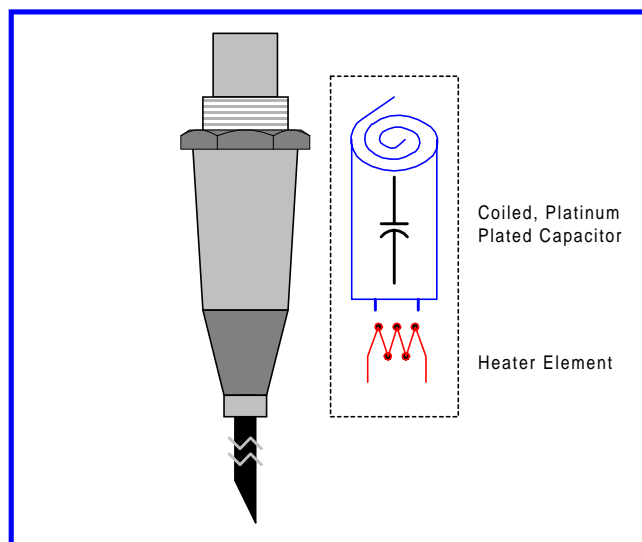
## Testing Automotive Engine Oxygen Sensors Using the 7000 Precision LCR Meter



Today's automobiles have evolved to the point of sophistication where engine control decisions are under command of the car's main processor. One important way of controlling the engines operation and efficiency is to control the presence of oxygen. Engine oxygen sensors are used to monitor the oxygen level of the exhaust and are installed into the manifold at a location where exhaust from all cylinders has merged. Testing these sensors after they have been assembled can turn out to be very cost effective; better to find the small number of defective units early rather than after the car has been assembled and on the road. An important impedance characteristic of these devices renders itself for **testing on the 7000 Series LCR Meters**.

### Physical Configuration

The typical oxygen sensor is comprised of a thin rolled ceramic material plated with platinum and exhibiting the characteristics of a capacitor. The sensor also includes a heater element for maintaining operating temperature, all of which is mounted in an enclosure for threading into the engine's manifold. During final assembly a laser weld is required to attach the enclosure to the threaded gasket portion, thus the ceramic capacitor, being especially fragile, is subject to cracking or damage during this process. For this reason, verification of electrical characteristics after assembly helps eliminate a number of possible defective devices.



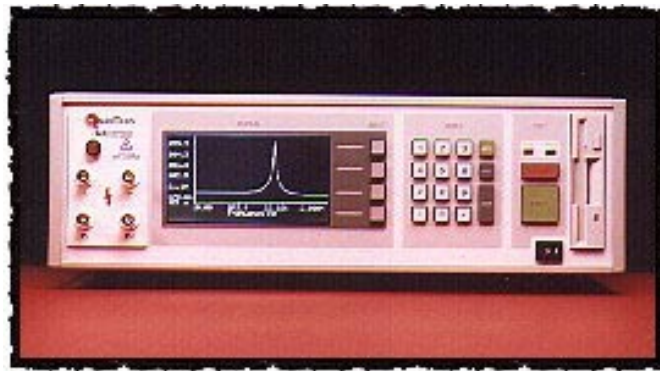
**Figure 1: Oxygen Sensor**

## Measurement Characteristics

Using the 7000 Series LCR Meter to measure the **C value of the capacitive element** is a proven way to eliminate defective units. Typical value is in the order of 100pF or slightly less and for those units considered defective a value 50% lower is commonplace. So why is this impedance characteristic important in determining sensor quality? Improper control of the engine based on oxygen analysis of the exhaust can have serious consequences. Too much oxygen can result in irreversible damage to the engine, or too little oxygen result in improper burning and cause air pollution. By real-time analysis of the engines exhaust the automobiles control system monitors the results and adjusts accordingly for optimum performance and efficiency.

### Important 7000 Instrument Features

The 7000 Series LCR Meter is ideal for this application because of some of its unique features. When measuring the low capacitance values of these devices the instrument's low noise level is important in obtaining useful and consistent results. The open/short circuit zeroing is critical in compensating for fixture and/or lead connection errors. The instrument's user-friendly operation along with the ability to quickly alter test conditions provides a great deal of flexibility to accommodate a wide variety of testing requirements.



**Figure 2: 7600 Precision LCR Meter**

For complete product specifications on the 7000 Series Precision LCR meters or any of QuadTech's products, visit us at <http://www.quadtech.com/resources/dataindex.html>. Do you have an application specific testing need? Call us at 1-800-253-1230 or email engineering at [rroetzer@quadtech.com](mailto:rroetzer@quadtech.com) and we'll work with you on a custom solution. Put QuadTech to the test because we're committed to solving your testing requirements.

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