

ECM Lambda (AFR, O₂) Sensor Calibration System

ECM's Lambda Sensor Calibration System provides a traceable and repeatable way to calibrate the Lambda (AFR, O₂) sensors used in ECM's Lambda 5220, EGR 5230, and LambdaCAN analyzers.

The Lambda sensors used in ECM's analyzers operate on a diffusion process. The pertinent diffusion coefficient Γ_{O_2} is determined by measuring the current output of the sensor in a known O₂ + H₂O + N₂ span gas. The units of Γ_{O_2} are mA/%O₂. Air is the recommended span gas and the %O₂ in air is 20.945% minus the oxygen displaced by humidity.

During operation in an engine, the sensor will output a current that will be interpreted as a positive %O₂ (when lean) or an imaginary negative %O₂ (when rich) via the calibrated Γ_{O_2} . Determination of Lambda (and AFR) from this point on is purely mathematical based on the composition of the fuel and chemical equilibrium calculations. To match "heritage" Lambda and AFR calculation methods used by your organization, user-entered "delta tables" (i.e. characteristic curves) for Lambda and %O₂ can be added to the calculation stream.

Thus, the traceability and repeatability of Lambda measurements hinges on the traceability and repeatability of determining the sensor's diffusion coefficient Γ_{O_2} (mA/%O₂). With the Lambda Sensor Calibration System, sensor current (mA) is measured with a LambdaCAN module and the %O₂ is measured using a baroCAN module. The LambdaCAN's accuracy is verified using a supplied precision current and voltage source (ECM Lambda Sensor Simulator). The simulator can also be used to verify the proper operation of Lambda 5220, EGR 5230, and LambdaCANs in the field. The baroCAN's accuracy is maintained by the calibrated humidity/temperature sensor and pressure sensor.

Operation of ECM's Lambda Sensor Calibration System is exceedingly simple: hang the sensor in air and follow the one page instruction attached to the front of the system. A video demonstration of the use and care of the calibration system is on the PC. The resultant calibration (Γ_{O_2}) is downloaded into a memory chip in the Lambda sensor's connector. After each calibration, a sensor age-factor is displayed which can be used to estimate the remaining useful life of the sensor. The sensor can then be distributed to users ensuring traceable and repeatability Lambda measurements throughout a large organization.

Maintenance of the Lambda Sensor Calibration System consists of returning the sensor simulator, the LambdaCAN's pressure sensor, and the baroCAN's humidity/temperature and pressure sensors to ECM for calibration on a recommended annual timetable.



ECM ENGINE CONTROL
AND MONITORING

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