THEORY OF OPERATION:

The DC-Johnson FAC-2 Air/Fuel ratio controller was originally designed in early 1982 for adaptation of European Specification Automobiles equipped with the Bosch L-Jetronic electronic fuel injection system, to meet US EPA regulations by adding closed-loop Air/Fuel ratio control. This design was later adapted for use with early LH (L-Jetronic with Hotwire Flowmeter), Motronic, and KE-Jetronic systems as well. Some of these variants were labeled FAC-3 to indicate installation of additional components in the circuit.

The FAC-2 consists of a comparator driven Air/Fuel ratio feedback control circuit which augments the coolant temperature sensor signal to the fuel injection Electronic Control Unit (ECU). This circuit provides a means to control the Air/Fuel ratio by monitoring an exhaust oxygen sensor, thereby creating a closed loop for Air/Fuel mixture ratio control.

For cold starting, a second comparator driven circuit maintains the original coolant sensor circuit path, bypassing the closed-loop Air/Fuel ratio control until the coolant temperature reaches a sufficient temperature to indicate completion of the cold start period.

The output leads of the FAC-2 are connected in series with the coolant temperature sensor. When the coolant temperature is low the coolant temperature sensor remains connected with the ECU as before and the system ignores the feedback signal from the exhaust oxygen sensor. The coolant temperature sensor is also connected to the positive input of Comparator U4. An adjustable resistor (Potentiometer R15), connected to the negative input of Comparator U4 sets the threshold at which the closed loop switches in after coolant temperature increases enough to bring the voltage at the positive input of U4 below the voltage at the negative input. Capacitor(s) C4 (and C7 on FAC-3 versions) provide an additional delay to allow time for the exhaust oxygen sensor to reach operating temperature on warm starts.

After the cold start circuit has switched over, the closed-loop Air/Fuel ratio control circuit is allowed to change the input to the ECU originally dedicated to the coolant temperature sensor in response to the Oxygen level measured in the exhaust by the exhaust oxygen sensor. When a lean mixture is detected the closed-loop Air/Fuel ratio control circuit signals the ECU to increase fuel delivery and when a rich mixture is detected fuel delivery is decreased. An adjustable resistor (Potentiometer R1) connected to the positive input of Comparator U1 provides a means to calibrate the circuit to attain the proper lambda switching setpoint of 0.5 volts DC.

GENERAL TIPS:

COLD START THRESHOLD:

Since the Cold start switch over is controlled by the threshold set at the wiper of Potentiometer R15 (Comparator U4 Negative Pin #3), and this potentiometer is capable of settings from 0 to 9.6 VDC (9.6 VDC is the regulated output of the Voltage Regulator U3) it is possible that if this potentiometer (R15) is improperly adjusted the unit will either switch over too early (voltage too high) or fail to switch over at all (voltage too low). The adjustment was originally provided for production bench calibration and was not intended to be adjusted in the field. If you suspect that it has been altered, it must be checked and recalibrated to the original setting of 2.0 VDC at U4 pin 3 for most versions. It may be acceptable to adjust it to an alternative setting within +/- 1.0 VDC of the original calibration to alter the length of the cold start period. Settings outside this range are not recommended. Any adjustments should be performed in a laboratory bench setting, not in the automobile. A reliable 12 VDC power supply and a voltmeter are the only electronic tools required (a non-conductive plastic screwdriver for adjustments is strongly recommended as well).

LAMBDA SETPOINT CALIBRATION:

The lambda setpoint calibration (R1) while limited in range to a maximum of approximately 0.96 VDC was also intended to be used during production bench calibration only. If you suspect that this setting has been altered, it must be checked and recalibrated to the original setting of 0.5 VDC as measured at pin 2 of U1. Once again, any adjustments should be performed in a laboratory bench setting, not in the automobile.

VERIFYING OPEATION:

The fastest way to verify operation is to attach an air fuel meter to the oxygen sensor.

1. When the sensor is attached to both the FAC-2 and the meter, the meter should oscillate from lean to rich at warm idle. The oscillation frequency should be between 0.5Hz and 2.0Hz (once every 2 seconds to twice per second).

2. When the sensor is connected to the meter only, it should indicate a full rich condition.

If an oscillation was observed in condition 1 and the meter was not reaching the full rich condition at times, either the sensor was not at full operating temperature (>490°F) or the oxygen sensor is defective, contaminated, or worn out. If any oscillation was observed, the FAC-2 is operating. If no oscillation was observed the FAC-2 may not be powered, may have a wiring error, or may be miscalibrated. Although far less likely than these other common causes, the FAC-2 may be damaged.

For further inquiries, please contact us by email: info@dc-johnson.com