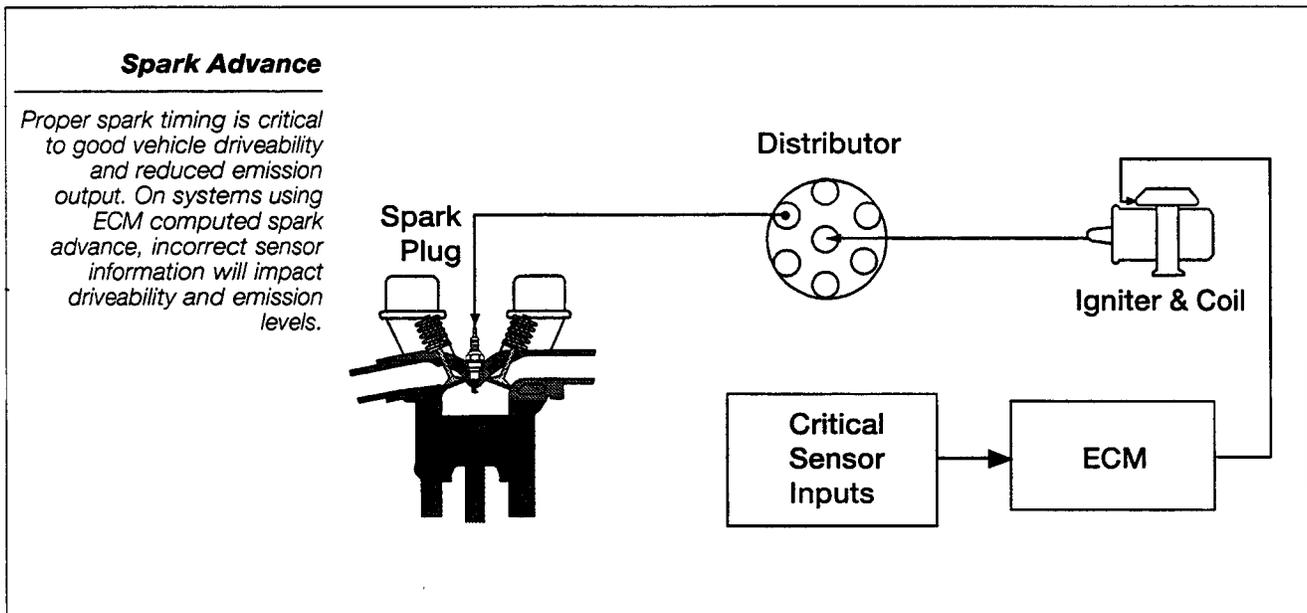


Spark Advance Control

The Spark Advance Control system maximizes engine efficiency by continuously adjusting spark advance timing to deliver peak combustion pressures when the piston reaches about 10° after TDC. Incorrect spark timing can have a significant effect on emission output and vehicle driveability. If ignition timing is excessively advanced during certain conditions, detonation will occur resulting in increased HC and NOx levels. Since NOx production is most predominant under loaded engine operating conditions, the spark advance system must ensure accurate ignition timing during these conditions. If ignition timing is incorrectly retarded, only partial combustion will take place resulting poor engine performance and increased emission levels.



Causes of Incorrect Spark Timing

On systems that use the ECM to compute ignition spark advance, there are only two conditions which are likely to cause spark timing to be incorrect; initial timing or a false input signal to the ECM.

The first step in troubleshooting emissions and driveability concerns should always include a quick check of **initial ignition timing**. Any error in initial timing will be reflected throughout the entire spark advance curve.

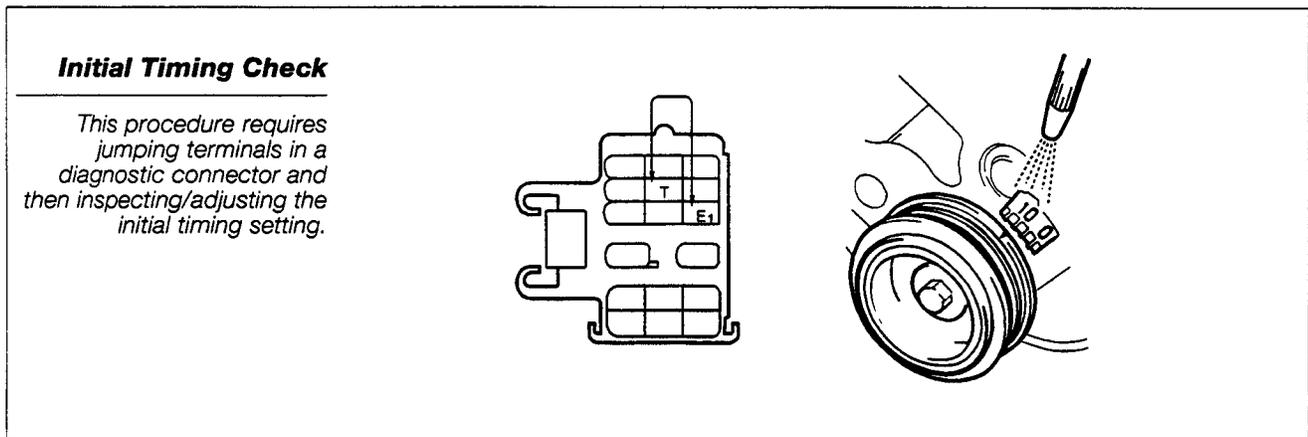
If engine load is miscalculated because of **incorrect input signals**, spark advance angle will not be appropriate for engine operating conditions. This will result in driveability and emission problems. Refer to course 850 for additional information on spark advance strategy.

Effects of Spark Advance on Emissions and Driveability

- **Too much spark advance**, particularly during high engine load conditions, increases the likelihood of engine detonation and increases combustion temperature and pressure. This results in an increase in HC and NOx output, decreased engine performance, and possible permanent damage the engine.
- **Too little spark advance** causes only partial combustion of the air/ fuel charge, resulting in very poor engine performance and fuel economy. Partial combustion will also result in an increase in CO levels.

Functional Testing

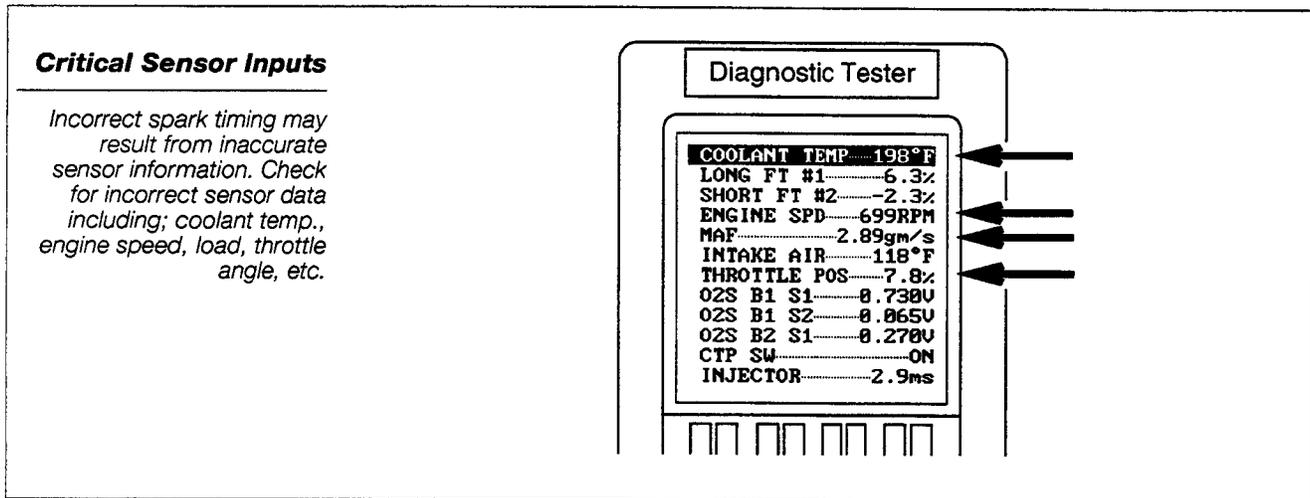
Spark advance problems can result from an incorrect initial timing setting or a problem with spark advance during operation. Before attempting to check spark advance during operating conditions, the initial or "base" ignition timing setting should checked and adjusted.



This procedure varies between systems, but on TCCS equipped vehicles, it generally requires jumping terminals at an underhood check connector (DLC1) to default the TCCS system to initial timing. After checking or adjusting initial timing, remove the test wire to inform the ECM to reestablish corrective control over timing. Refer to the Repair Manual for details on performing this procedure.

ENGINE SUB SYSTEMS - Spark Advance Control

Even with initial timing correct, it is still possible that the system is miscalculating ignition timing as a result of incorrect sensor inputs. For example, if an airflow meter indicates light engine load, when in fact, the engine is experiencing high engine load, the ECM may incorrectly respond by over advancing ignition timing to the point of causing detonation. Refer to course 850 and 873 handbook for additional information on spark advance control strategy.



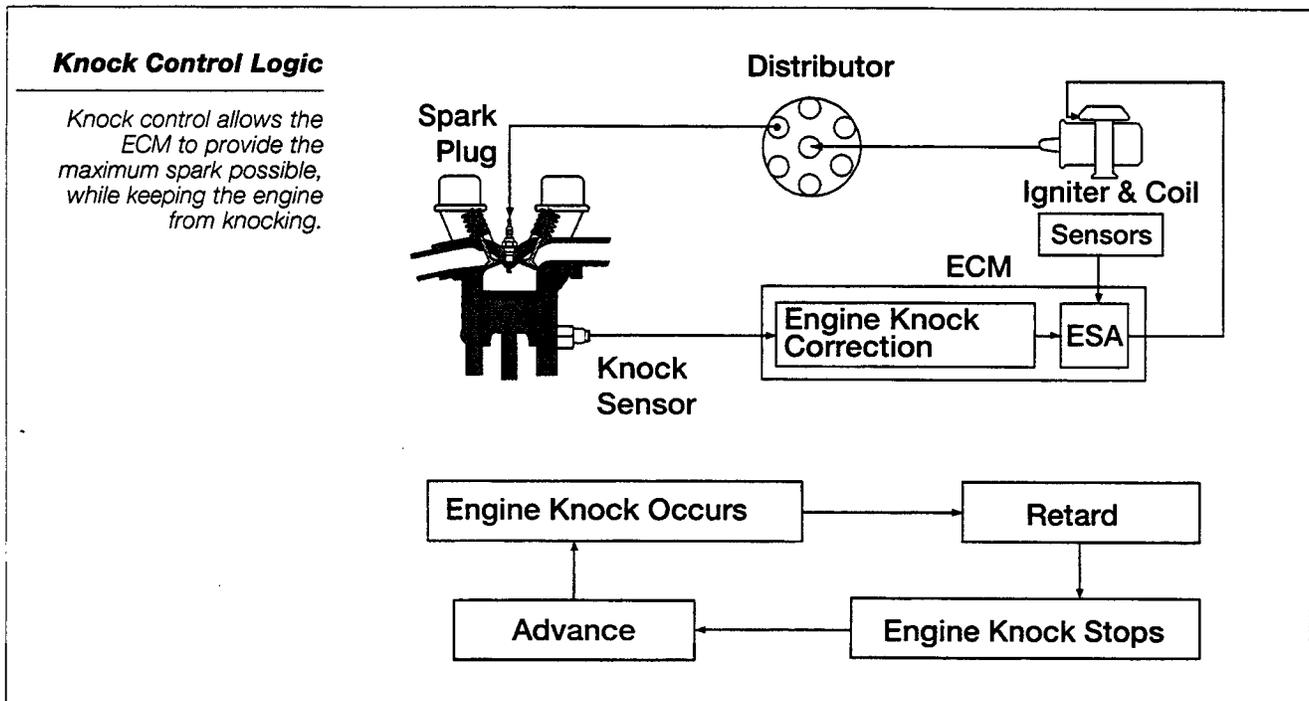
If inaccurate sensor inputs are suspected on earlier EFI and TCCS vehicles, it is recommended that you perform standard voltage checks of all major sensor inputs to the ECM. Compare these readings to those listed on the standard voltage chart on the Repair Manual or readings obtained from other known good vehicles. On OBD-II vehicles, you may observe ignition timing and identify incorrect signal data using the Diagnostic Tester. Some of the more important spark control parameters include engine speed, engine load, throttle angle, and coolant temperature.

On early EFI vehicles, all spark advance is handled by mechanical means. This system uses a centrifugal advance mechanism to represent engine speed and vacuum advance mechanism to represent engine load. Resolving advance problems with this type system requires inspecting governor weights, springs, pivots, signal rotor, vacuum diaphragm, vacuum signal source, breaker plate, etc.

ENGINE SUB SYSTEMS - Spark Advance Control

Knock Detection Control

The KNK (knock) input signal is critical in the prevention of engine detonation. The ECM uses the knock sensor(s) to determine when, and to what degree, engine detonation is occurring and then retards ignition timing as needed. The spark advance program is designed to provide the maximum spark advance possible, while keeping the engine from producing an audible "ping". If problems occur with this input signal, detonation may result, producing significant levels of HC and NOx emissions.



The ECM is designed to filter out KNK signal voltages that it considers are outside of the engine detonation range. Thus, a check of a knock control system by tapping on the engine close to the knock sensor may produce an output signal, but will not cause spark timing to retard. A check of the KNK signal pattern using the Diagnostic Tester Oscilloscope or lab scope may provide you the most diagnostic information.