# Comprehensive Component Monitor (CCM)

The CCM monitors for concerns in any powertrain electronic component or circuit that provides input or output signals to the powertrain control module (PCM) that can affect emissions and is not monitored by another on board diagnostics (OBD) monitor. Inputs and outputs are, at a minimum, monitored for circuit continuity or correct range of values. Where feasible, inputs are also checked for rationality, and outputs are also checked for correct functionality.

The CCM covers many components and circuits and tests them in various ways depending on the hardware, function, and type of signal. For example, analog inputs such as throttle position or engine coolant temperature are typically checked for opens, shorts, and out-of-range values. This type of monitoring is carried out continuously. Some digital inputs like brake switch or crankshaft position rely on rationality checks that are checking to see if the input value makes sense at the current engine operating conditions. These types of tests may require monitoring several components and can only be carried out under the appropriate test conditions.

Outputs such as coil drivers are checked for opens and shorts by monitoring a feedback circuit or smart driver associated with the output. Other outputs, such as relays, require additional feedback circuits to monitor the secondary side of the relay. Some outputs are also monitored for correct function by observing the reaction of the control system to a given change in the output command. An idle air control solenoid can be functionally tested by monitoring the idle RPM relative to the target idle RPM. Some tests can only be carried out under the appropriate test conditions. For example, the transmission shift solenoids can only be tested when the PCM commands a shift.

The following is an example of some of the input and output components monitored by the CCM. The component monitor may belong to the engine, ignition, transmission, air conditioning, or any other PCM supported subsystem.

1. Inputs:

   Air conditioning pressure (ACP) transducer sensor, camshaft position (CMP) sensor, crankshaft position (CKP) sensor, engine coolant temperature (ECT) sensor, engine oil temperature (EOT) sensor, fuel rail pressure temperature (FRPT) sensor, fuel tank pressure (FTP) sensor, intake air temperature (IAT) sensor, mass air flow (MAF) sensor, throttle position (TP) sensor.

2. Outputs:

   EVAP canister purge valve, EVAP canister vent (CV) solenoid, fuel injector, fuel pump (FP), idle air control (IAC), intake manifold runner control (IMRC), shift solenoid, torque converter clutch (TCC) solenoid, variable camshaft timing (VCT) actuator, wide open throttle A/C cutout (WAC).

3. The CCM is enabled after the engine starts and is running. A diagnostic trouble code (DTC) is stored in keep alive memory (KAM) and the malfunction indicator lamp (MIL) is illuminated after 2 driving cycles when a concern is detected. Many of the CCM tests are also carried out during an on-demand self-test.



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