Figure 71-1  All computer systems perform four basic functions: input, processing, storage, and output.

Figure 71-2  A potentiometer uses a movable contact to vary resistance and send an analog voltage right to the PCM.
Figure 71-3: An AD converter changes analog (variable) voltage signals into digital signals that the ECM can process.

Figure 71-4: Many electronic components are used to construct a typical vehicle computer including chips, resistors, and capacitors.

Figure 71-5: Typical engine map developed from testing and used by the vehicle computer to provide the optimum ignition timing for all engine speeds and load combinations.
Figure 71-6 The clock generator produces a series of pulses that are used by the microprocessor and other components to stay in step with each other at a steady rate.

Figure 71-7 The powertrain control module (PCM) is located under the hood on this Chevrolet pickup truck.

Figure 71-8 This PCM on a Chrysler vehicle can only be seen by lifting the vehicle, because it is located next to the radiator and in the airflow to help keep it cool.
FREQUENTLY ASKED QUESTION: What Is a Binary System?

In a digital computer, the signals are simple high-low, on-off signals. The digital signal voltage is limited to two voltage levels: high voltage and low voltage. Since there is no stepped range of voltage or current inherent in a binary system, the digital binary signal is a "square wave." The signal is called "digital" because the on and off signals are processed by the computer as the digits or numbers 0 and 1. This number system can change only these two digits in the binary system, any number or letter from any number system or language alphabet can be converted into a combination of ones (1s) and zeros (0s) for the digital computer. A digital computer changes the analog input signals (voltage) to digital bits (binary digits) of information through an analog-to-digital converter circuit. The binary digital number is used by the computer in its calculations or logic networks. Output signals usually are digital signals that turn system actuators on and off.

**Figure 71-9** A typical output driver. In this case, the PCM applies voltage to the fuel pump relay to energize the fuel pump.

**Figure 71-10** A typical low-side driver (LSD) which uses a control module to control the ground side of the relay coil.
A typical module-controlled high-side driver (HSD) where the module itself supplies the electrical power to the device. The “logic” portion inside the module can detect circuit faults including continuity of the circuit and if there is a short-to-ground in the circuit being controlled.

Both the top and bottom pattern have the same frequency. However, the amount of on-time varies. Duty cycle is the percentage of the time during a cycle that the signal is turned on.