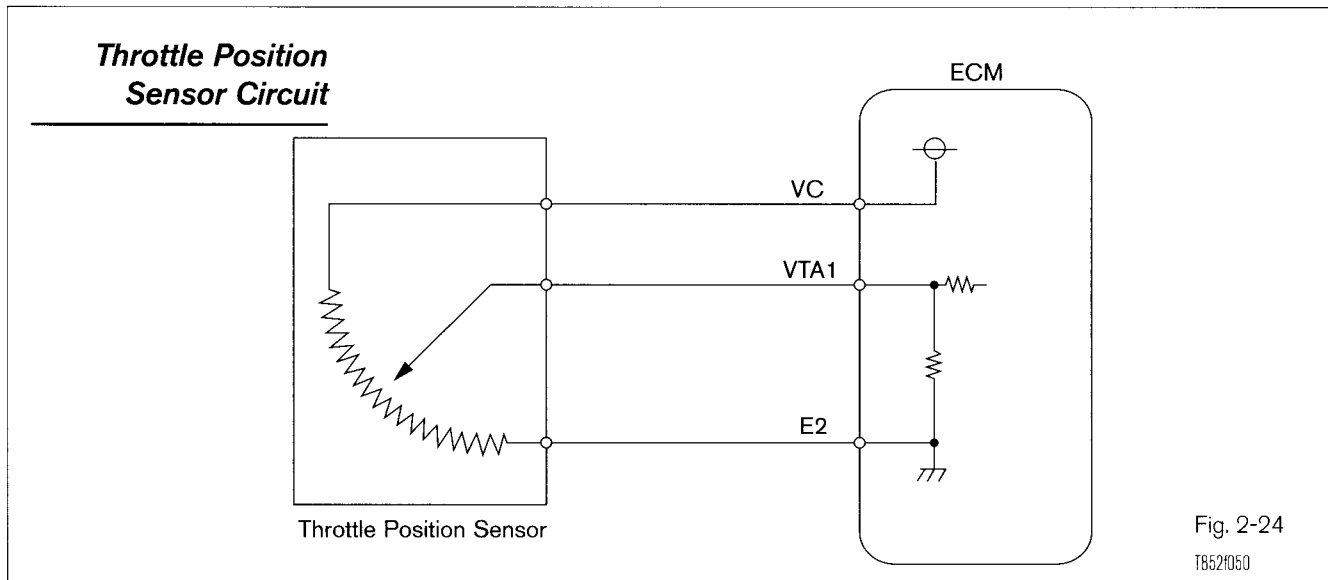


## Position Sensors

In many applications, the ECM needs to know the position of mechanical components. The Throttle Position Sensor (TPS) indicates position of the throttle valve. Accelerator Pedal Position (APP) sensor indicates position of the accelerator pedal. Exhaust Gas Valve (EGR) Valve Position Sensor indicates position of the EGR Valve. The vane air flow meter uses this principle.

Electrically, these sensors operate the same way. A wiper arm inside the sensor is mechanically connected to a moving part, such as a valve or vane. As the part moves, the wiper arm also moves. The wiper arm is also in contact with a resistor. As the wiper arm moves on the resistor, the signal voltage output changes. At the point of contact the available voltage is the signal voltage and this indicates position. The closer the wiper arm gets to VC voltage, the higher the signal voltage output. From this voltage, the ECM is able to determine the position of a component.



## Throttle Position Sensor

The TPS is mounted on the throttle body and converts the throttle valve angle into an electrical signal. As the throttle opens, the signal voltage increases.

The ECM uses throttle valve position information to know:

- engine mode: idle, part throttle, wide open throttle.
- switch off AC and emission controls at Wide Open Throttle (WOT).
- air-fuel ratio correction.
- power increase correction.
- fuel cut control.

The basic TPS requires three wires. Five volts are supplied to the TPS from the VC terminal of the ECM. The TPS voltage signal is supplied to the VTA terminal. A ground wire from the TPS to the E2 terminal of the ECM completes the circuit.

At idle, voltage is approximately 0.6 - 0.9 volts on the signal wire. From this voltage, the ECM knows the throttle plate is closed. At wide open throttle, signal voltage is approximately 3.5 - 4.7 volts.

Inside the TPS is a resistor and a wiper arm. The arm is always contacting the resistor. At the point of contact, the available voltage is the signal voltage and this indicates throttle valve position. At idle, the resistance between the VC (or VCC terminal and VTA terminal is high, therefore, the available voltage is approximately 0.6 - 0.9 volts. As the contact arm moves closer the VC terminal (the 5 volt power voltage), resistance decreases and the voltage signal increases.

## TPS With Idle Contact Switch Circuit

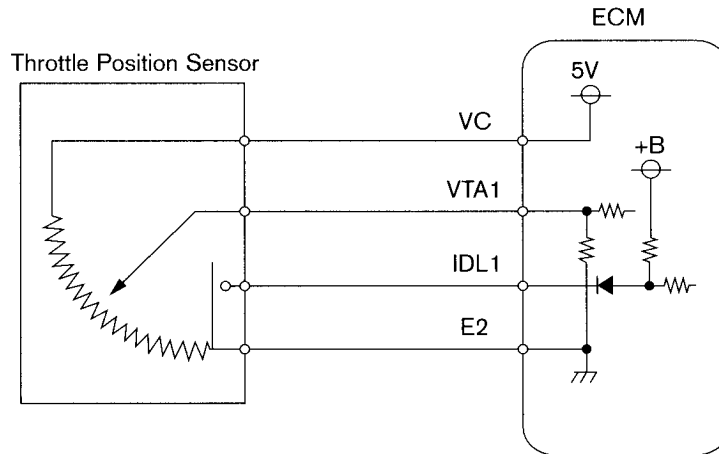


Fig. 2-25  
T8521051

## TPS With IDL

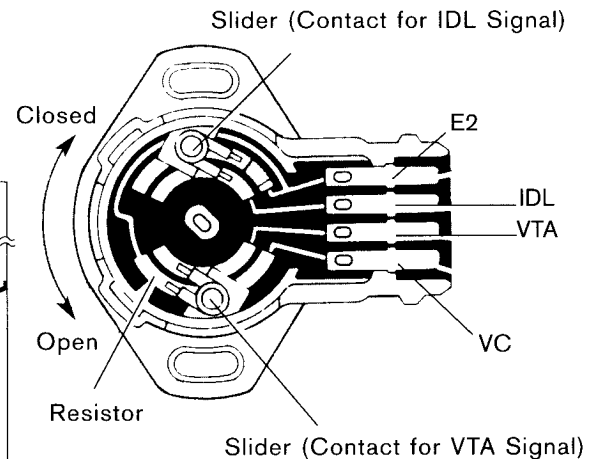
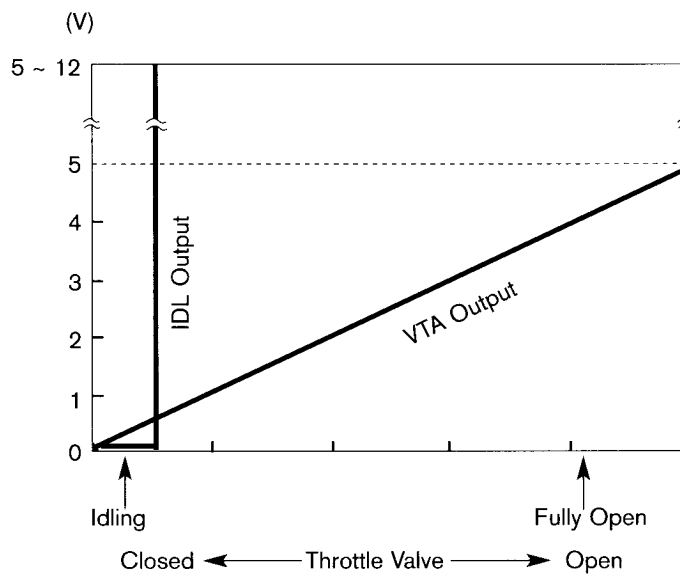
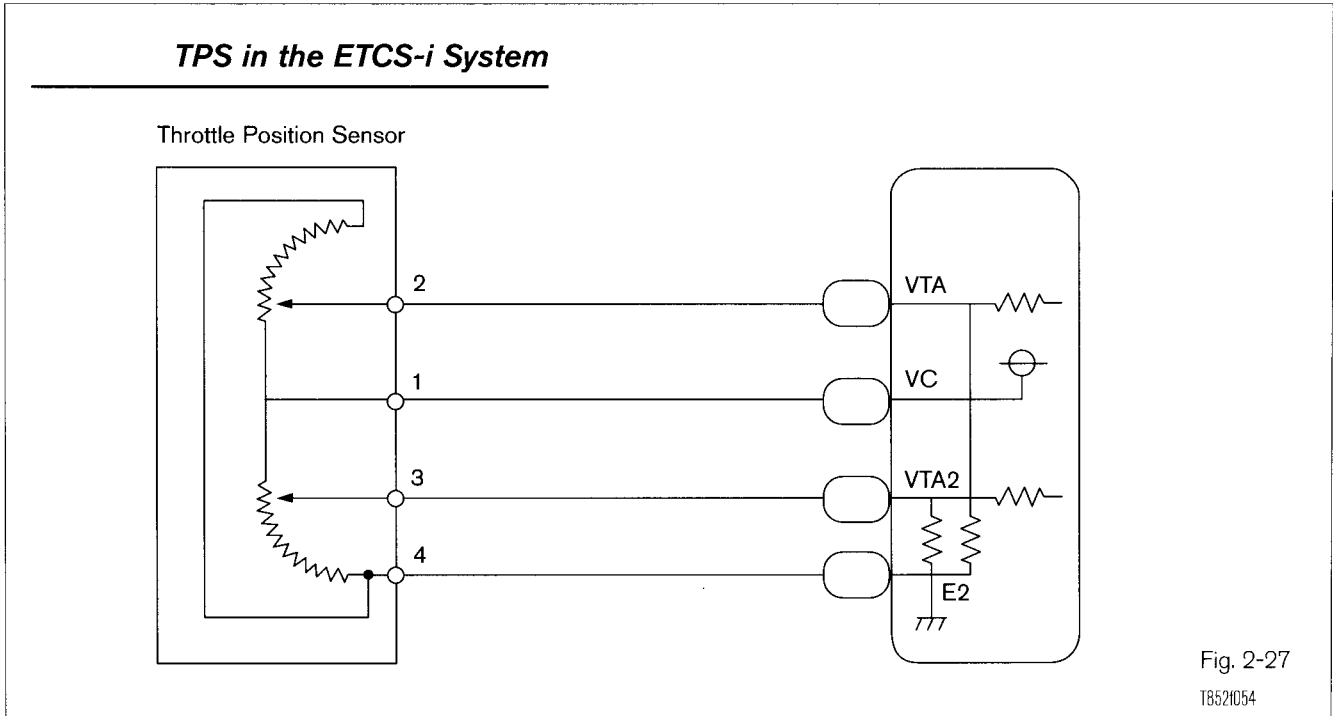
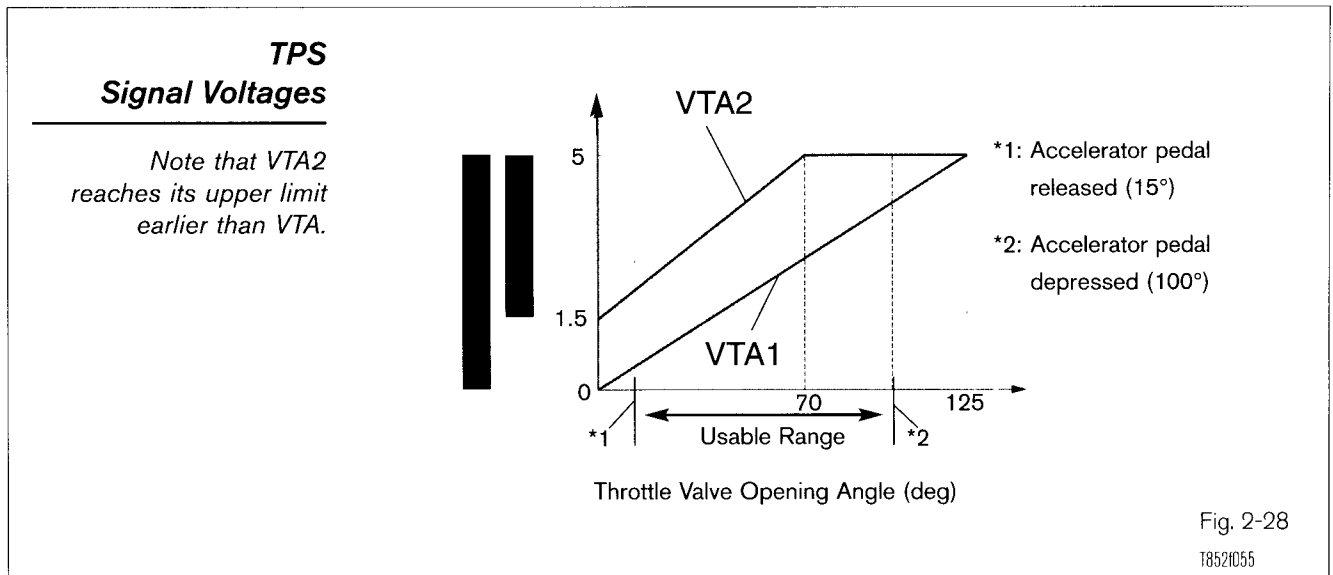


Fig. 2-26  
T8521053/T8521052

Some TPS incorporate a Closed Throttle Position switch (also called an idle contact switch). This switch is closed when the throttle valve is closed. At this point, the ECM measures 0 volts and there is 0 volts at the IDL terminal. When the throttle is opened, the switch opens and the ECM reads +B voltage at the IDL circuit.



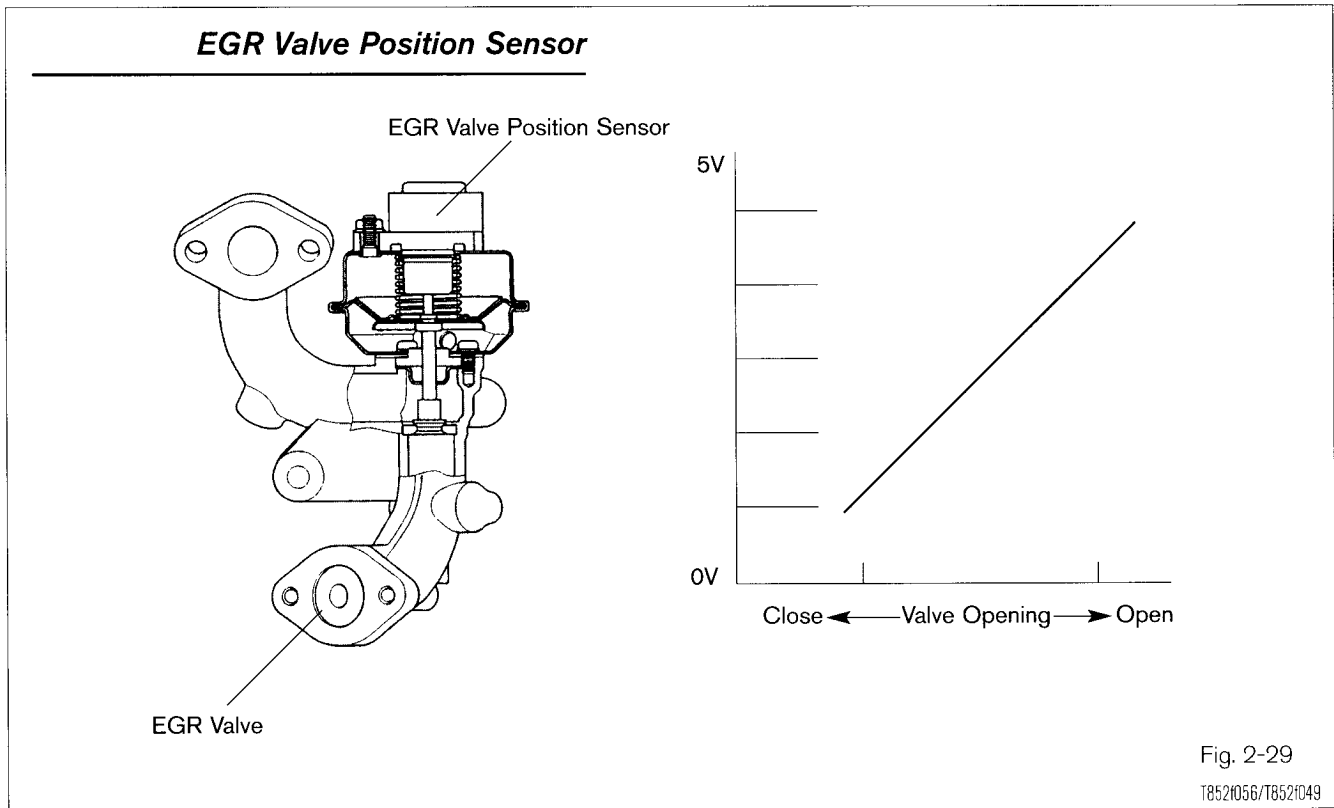
The TPS on the ETCS-i system has two contact arms and two resistors in one housing. The first signal line is VTA1 and the second signal line is VTA2.



VTA2 works the same, but starts at a higher voltage output and the voltage change rate is different from VTA1. As the throttle opens the two voltage signals increase at a different rate. The ECM uses both signals to detect the change in throttle valve position. By having two sensors, ECM can compare the voltages and detect problems.

## Accelerator Pedal Position (APP) Sensor

The APP sensor is mounted on the throttle body of the ETCS-i. The APP sensor converts the accelerator pedal movement and position into two electrical signals. Electrically, the APP is identical in operation to the TPS.



## EGR Valve Position Sensor

The EGR Valve Position Sensor is mounted on the EGR valve and detects the height of the EGR valve. The ECM uses this signal to control EGR valve height. The EGR Valve Position Sensor converts the movement and position of the EGR valve into an electrical signal. Operation is identical to the TPS except that the signal arm is moved by the EGR valve.

## Position Sensor Diagnostics

The following explanations are to help you with the diagnostic procedures in the Repair Manual. The explanations below are representative to the order listed in the RM. You may find different orders in the RM.

## Diagnostic Tester

Comparing the position of the sensor to Diagnostic Tester data is a convenient way of observing sensor operation. For example, with the TPS, the lowest percentage measured with Key On/Engine Off is with the throttle valve at its minimum setting, and the highest percentage will be at Wide Open Throttle.

## Checking Supply Voltage Between Terminal VC and Body Ground

Disconnecting the sensor connector and measuring the voltage at the VC terminal you should get about 5 volts. If you get this reading it confirms that the wire is good and ECM is providing the correct voltage. If not, the problem may be with the circuit or ECM.

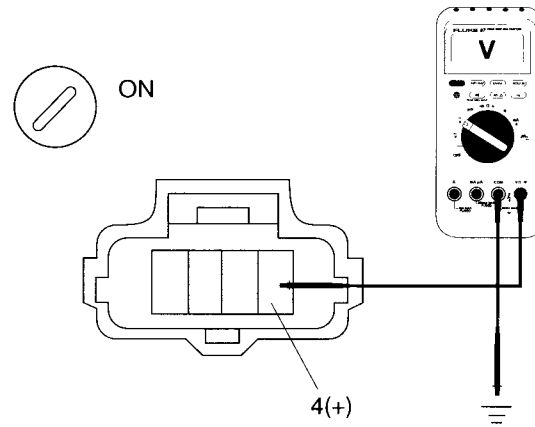


Fig. 2-30

T8521057

## Check Voltage Between Terminals VC and E2 of ECM Connector

This test confirms that the ECM is putting out the necessary supply voltage. You would do this test if you did not measure 5 volts at the VC terminal at the TPS connector. If you get 5 volts at the ECM connector, the problem is in the harness. If you did not get 5 volts, the ECM is at fault.

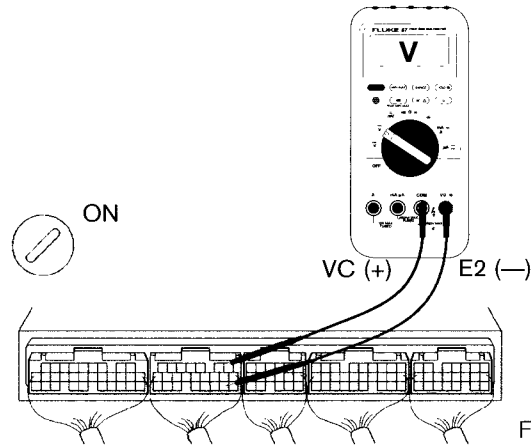


Fig. 2-31

T8521058

## Inspect Throttle Position Sensor

On some models, you will find TPS checks in the Throttle Body on Vehicle Inspection in the SF Section.

### TPS Resistance Check

A DVOM is used to measure the resistance of the sensor at the specified terminal location.

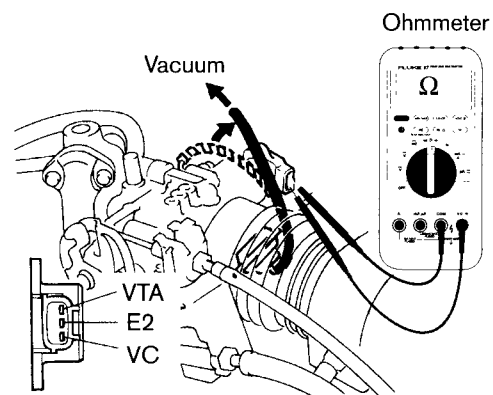


Fig. 2-32

T8521059

**TPS Total Resistance Check**

*This resistance test is measuring total resistance.*

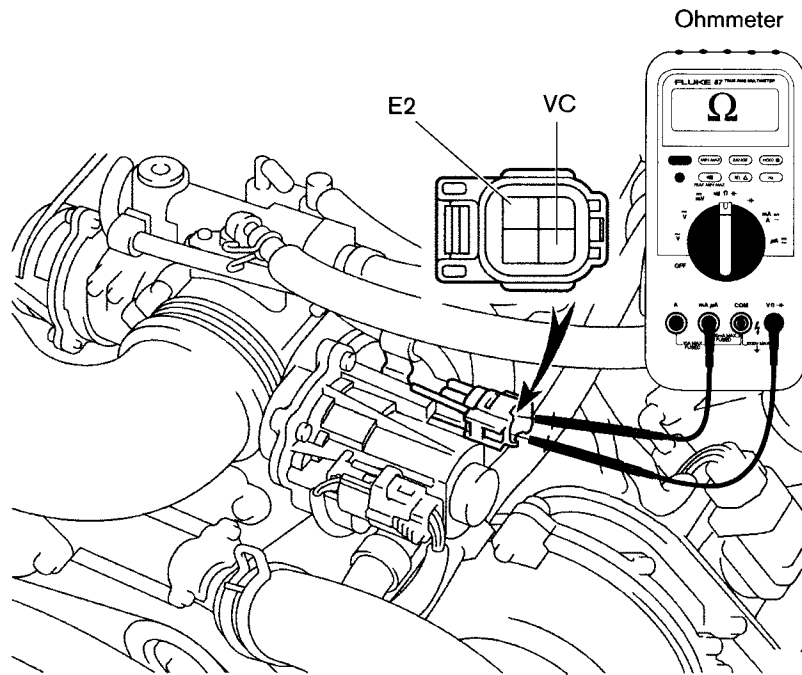


Fig. 2-33  
T852f060

**Check Voltage Between Terminals VTA and E2 of ECM Connector**

*This test is to determine if the circuit or the ECM is at fault. If voltage readings are in specifications, the ECM may be at fault. (Intermittent problems in the circuit or sensor may also be the problem.) If voltage readings are not in specifications, an open or short in the harness and connector between ECM and TPS on the VTA or E2 line.*

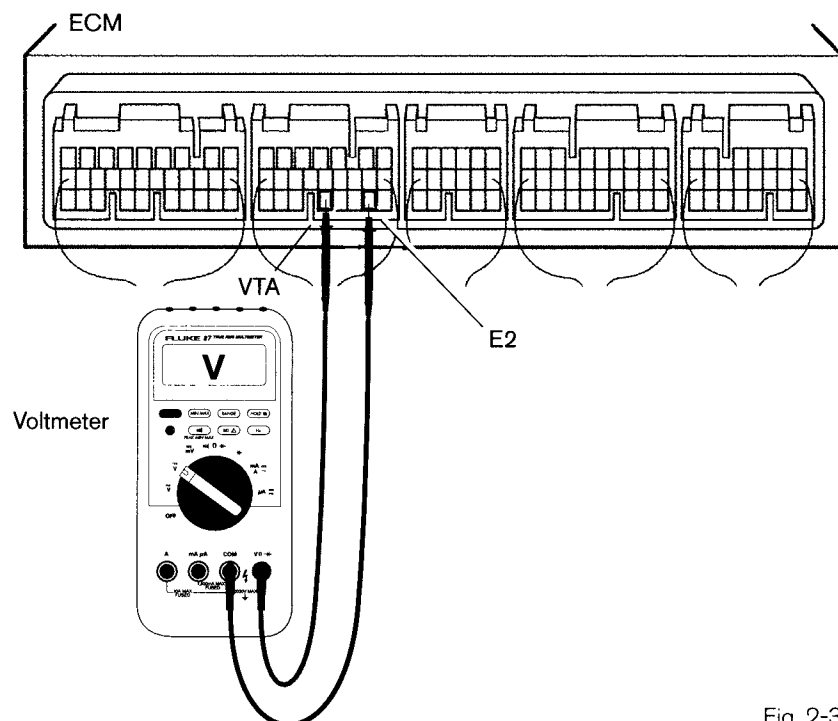


Fig. 2-34  
T852f061

### ASSIGNMENT

NAME: \_\_\_\_\_

1. What are some of the common uses of position sensors? List them.
2. Explain how a position sensor (potentiometer) works?
3. Draw a sample position sensor circuit. Label all parts.
4. The PCM (ECM) uses throttle valve position information to control what functions?
5. Why do some TPS have an IDL contact and how does the PCM use this information?
6. What are the typical voltage values of a TPS? (Reference, idle, WOT)
7. Why does the PCM use an EGR position sensor and how is it used? Explain the strategy behind this sensor.
8. Explain the testing procedure for a position sensor such as a TPS. (In detail)