

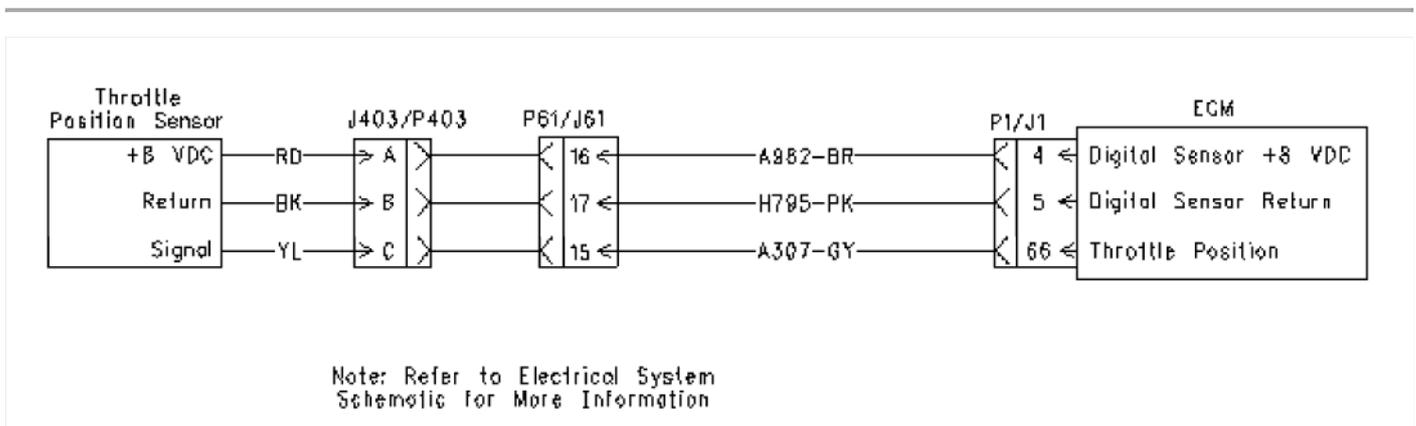
Throttle Position Sensor Circuit - Test

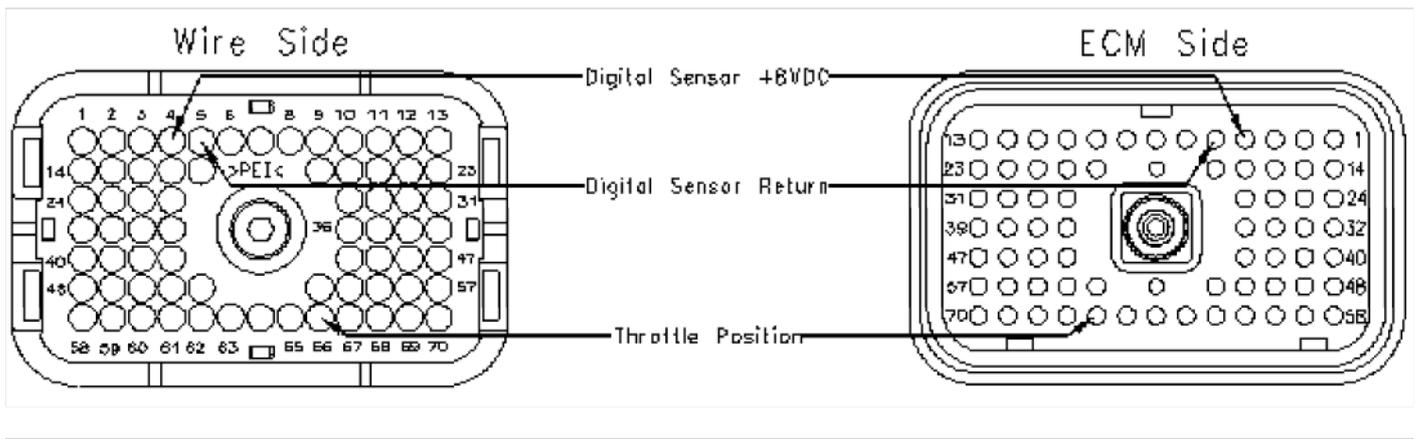
System Operation Description:

The throttle position sensor is mounted to a pedal assembly. The throttle position sensor provides a signal to the Electronic Control Module (ECM). The geometry of the pedal assembly controls both the travel of the sensor and the range of the output signal. The throttle position sensor cannot be adjusted.

The output of the throttle position sensor is a pulse width modulated signal that varies with the position of the throttle. The throttle position sensor produces a minimum duty cycle in the released position. The throttle position sensor produces a maximum duty cycle in the fully depressed position. When the pedal is released, the ECM translates the output signal to a throttle position of 0 percent. When the pedal is fully depressed, the ECM translates the output signal to a throttle position of 100 percent.

Note: The throttle position sensor receives a supply of 8 VDC from the ECM. This supply is common with all digital sensors. Troubleshoot any active diagnostic codes that are related to the digital sensor supply before attempting this troubleshooting procedure.





P1 ECM connector

Test Step 1. Inspect Electrical Connectors and Wiring

- A. Turn the keyswitch to the OFF/RESET position.
- B. Thoroughly inspect the J1/P1 ECM connector, the J61/P61 machine connector, and the J403/P403 throttle position sensor connector. Refer to Troubleshooting, "Electrical Connectors - Inspect" for details.

Expected Result:

All connectors, pins, and sockets are completely inserted and coupled. The harness and wiring are free of corrosion, of abrasion, and of pinch points.

Results:

- **OK** - The connectors and the wiring appear to be OK. Proceed to Test Step 2.
- **Not OK** - There is a problem with the connectors and/or the wiring.

Repair: Repair the circuit. Verify that the repair eliminates the problem.

STOP

Test Step 2. Inspect the Throttle Pedal Assembly

- A. Inspect the throttle pedal assembly for components that are loose, bent, missing, or worn.
- B. Slowly depress the pedal and release the pedal.

Expected Result:

The throttle pedal assembly operates smoothly without excessive drag. The pedal returns to the low idle position without assistance in less than one second.

Results:

- **OK** - The throttle pedal assembly functions properly. Proceed to Test Step 3.
- **Not OK** -

Repair: Repair the throttle pedal assembly, as required.

STOP

Test Step 3. Check the Status of the Throttle Position Sensor

- A. Connect the Caterpillar Electronic Technician (Cat ET) to the service tool connector.
- B. Turn the keyswitch to the ON position.
- C. Observe the status of "Throttle Position" on Cat ET while you operate the throttle pedal.

Expected Result:

The status is approximately 0 percent when the throttle pedal is released. The status progressively increases to 100 percent when the throttle pedal is fully depressed.

Note: This range can change depending on the adjustment of the throttle pedal assembly.

Results:

- **OK** - The throttle position sensor is working properly.

Repair: Refer to Troubleshooting, "Electrical Connectors - Inspect" if the problem is intermittent.

STOP

- **Not OK** - Proceed to Test Step 4.

Test Step 4. Check the Supply Voltage at the Sensor

- A. Install a **7X-6370** Adapter Cable (3 Pin DT Breakout) at the J403/P403 throttle position sensor connector.
- B. Turn the keyswitch to the ON position.
- C. Measure the voltage across terminal A (Digital Sensor +8 VDC) and terminal B (Digital Return) at the breakout.

Expected Result:

The supply voltage is 8.0 ± 0.5 VDC.

Results:

- **OK** - The sensor is receiving the correct supply voltage. Proceed to Test Step 5.
- **Not OK** - The correct supply voltage is not reaching the sensor.

Repair: Proceed to Troubleshooting, "Digital Sensor Supply Circuit - Test".

STOP

Test Step 5. Check the Isolated Signal Frequency and the Duty Cycle at the Sensor

- A. Remove the wire from the harness side of P403:C (Signal).
- B. Turn the keyswitch to the ON position.
- C. Measure the frequency and the duty cycle between terminal B (Digital Return) and terminal C (Signal) at the J403/P403 breakout while you operate the throttle pedal.
- D. Turn the keyswitch to the OFF/RESET position.

E. Reinstall the wire in P403:C (Signal).

Expected Result:

The frequency is between 150 and 1000 Hz. The duty cycle is between 10 and 22 percent when the pedal is released. The duty cycle is between 75 and 90 percent when the pedal is fully depressed.

Results:

- **OK** - The sensor is producing a valid signal. Proceed to Test Step 6.
- **Not OK** - The sensor is not producing a valid signal.

Repair: Replace the throttle position sensor. Verify that the repair eliminates the problem.

STOP

Test Step 6. Check for a Short Circuit in the Wiring Harness

A. Disconnect the J1/P1 ECM connector and the J403/P403 throttle position sensor connector.

B. Measure the following resistances:

- P403:A (Digital Sensor +8 VDC) to P403:B (Digital Return)
- P403:A (Digital Sensor +8 VDC) to P403:C (Throttle Position)
- P403:B (Digital Return) to P403:C (Throttle Position)

Expected Result:

The resistance is greater than 20,000 Ohms for each measurement.

Results:

- **OK** - There are no shorts in the harness. Proceed to Test Step 7.
- **Not OK** - There is a short circuit in the harness or connectors.

Repair: Repair the circuit. Verify that the repair eliminates the problem.

STOP

Test Step 7. Check the Resistance through the Harness

A. Fabricate a jumper wire with pins at both ends.

B. Use the jumper wire to short P403:A (Digital Sensor +8 VDC) and P403:C (Throttle Position) together.

C. Measure the resistance between P1:66 (Throttle Position) and P1:4 (Digital Sensor +8 VDC).

D. Move the one end of the jumper wire from P403:A (Digital Sensor +8 VDC) to P403:B (Digital Return). Leave the other end in P403:C (Throttle Position).

E. Measure the resistance between P1:66 (Throttle Position) and P1:5 (Digital Sensor Return).

F. Remove the jumper wire and reconnect all of the connectors.

Expected Result:

The resistance is less than 10 Ohms for each measurement.

Results:

- **OK** - The harness is good. Proceed to Test Step 8.
- **Not OK** - There is an open circuit or excessive resistance in the harness or the connectors.

Repair: Repair the circuit. Verify that the repair eliminates the problem.

STOP

Test Step 8. Check the Signal Frequency and the Duty Cycle at the ECM

- Remove the signal wire from J2:66 (Throttle Position).
- Turn the keyswitch to the ON position.
- Measure the frequency and the duty cycle between the signal wire and the ECM ground strap while you operate the throttle pedal.
- Turn the keyswitch to the OFF/RESET position.
- Reinstall the signal wire in J2:66.

Expected Result:

The frequency is between 150 and 1000 Hz. The duty cycle is between 10 and 22 percent when the pedal is released. The duty cycle is between 75 and 90 percent when the pedal is fully depressed.

Results:

- **OK** - A valid sensor signal is reaching the ECM. Proceed to Test Step 9.
- **Not OK** - There is an intermittent problem in the wiring harness or the connectors.

Repair: Repair the circuit. Verify that the repair eliminates the problem.

STOP

Test Step 9. Check the Status on Cat ET

- Turn the keyswitch to the ON position.
- Observe the status for "Throttle Position" on Cat ET while you operate the throttle pedal.

Expected Result:

The status reads approximately 0 percent when the throttle pedal is released. The status progressively increases to 100 percent when the throttle pedal is fully depressed.

Note: This range can change depending on the adjustment of the throttle pedal assembly.

Results:

- **OK** - The throttle position sensor is working properly.

Repair: Refer to Troubleshooting, "Electrical Connectors - Inspect" if the problem is intermittent.

STOP

- **Not OK** - A valid signal appears at the ECM, but the ECM is not reading the signal properly.

Repair: Replace the ECM. Refer to Troubleshooting, "Replacing the ECM" before replacing the ECM.

STOP