DD: Fuel Rail Pressure Temperature (FRPT) Sensor

WARNING: Vehicle fuel systems are pressurized even when the engine is not running. To avoid fire or personal injury, disable the fuel delivery system and relieve fuel system pressure before removing any fuel system component. Refer to the fuel system information at the beginning of pinpoint HC. Failure to follow these instructions may result in personal injury.

Note: *With the engine running, the FRP PID value may be 48-70 kPa (7-10 psi) higher than a fuel pressure reading taken with a mechanical gauge.*

This pinpoint test is intended to diagnose the following:

- fuel rail pressure temperature (FRPT) sensor (9G756)
- harness circuits: FRP and FRT
- powertrain control module (PCM) (12A650)

Tables and Graphs

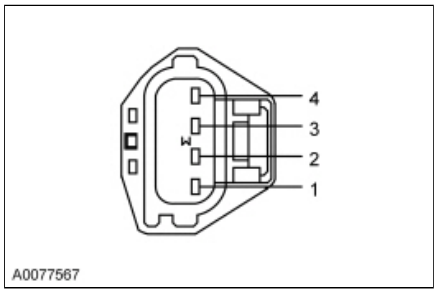
FRPT SENSOR VOLTAGE AND PRESSURE SPECIFICATIONS

Voltage	Pressure (kPa)	Pressure (psi)
4.5	482	70
3.9	413	60
3.4	344	50
2.8	275	40
2.2	207	30
1.6	138	20
1.1	69	10
0.5	0	0

FRPT SENSOR TEMPERATURE, VOLTAGE, AND RESISTANCE SPECIFICATIONS

Temperature		Sensor	
°C	°F	Volts	K Ohms
100	212	0.47	2.073
95	203	0.54	2.405
90	194	0.61	2.800
85	185	0.70	3.273
80	176	0.80	3.840
75	167	0.92	4.524
70	158	1.06	5.351
65	149	1.21	6.356
60	140	1.38	7.584
55	131	1.56	9.091
50	122	1.77	10.949
45	113	1.99	13.252
40	104	2.23	16.123
35	95	2.48	19.720
30	86	2.74	24.253
25	77	3.00	30.000
20	68	3.26	37.332
15	59	3.50	46.745
10	50	3.73	58.911
5	41	3.95	74.745
0	32	4.13	95.501

Fuel Rail Pressure Temperature (FRPT) Sensor Connector



Pin	Circuit
3	FRT (Fuel Rail Temperature)
1	FRP (Fuel Rail Pressure)
4	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to Section 6.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E40 E28 E41 E37	VREF FRT SIGRTN FRP
F-150, Mark LT	190 Pin	E57 E19 E58 E32	VREF FRT SIGRTN FRP
All other vehicles	170 Pin	E57 E19 E58 E32	VREF FRT SIGRTN FRP

DD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)
Are DTCs P0180, P0181, P0182, P0183, P0190, P0191, P0192 or P0193 present?

Yes	For DTC P0180, GO to DD24. For DTC P0181, GO to DD26. For continuous memory DTCs P0182 or P0183, GO to DD2. For KOEO and KOER DTCs P0182 or P0183, GO to DD17. For continuous memory DTC P0190, GO to DD3. For DTC P0191, GO to DD11. For continuous memory DTCs P0192 or P0193, GO to DD16. For KOEO and KOER DTCs P0192 or P0193, GO to DD3.
No	For all others, GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Descriptions.

DD2 CHECK THE FRPT AND PCM CONNECTORS FOR DAMAGE

- Key ON, engine OFF.
- Access the PCM and monitor the FRT PID.

- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
  - Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM
- Check the FRPT and PCM connectors for damage and corrosion.

Is a concern present?

Yes	ISOLATE the concern and REPAIR as necessary.
No	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Descriptions.

DD3 CONTINUOUS MEMORY DTC P0190, KOEO AND KOER DTCS P0192 AND P0193: CHECK THE FRPT SENSOR FOR FUEL LEAKS

Note: *Repair any fuel pump DTCs prior to this test.*

- Key ON, engine running.
- Idle the engine for 2 minutes.
- Inspect the FRPT vacuum hose between the intake manifold and the FRPT sensor for air leaks and correct connection.
- Key in OFF position.
- Remove the vacuum hose from the FRPT.
- Inspect the FRPT and vacuum hose for traces of fuel.

Is any fuel present?

Yes	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test HC. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. CLEAR the DTCs. REPEAT the self-test.
No	GO to DD4.

DD4 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Connect the vacuum hose to the FRPT.
- FRPT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 4

Is the voltage between 4.5 - 5.5 V?

Yes	For DTC P0190, GO to DD12. For DTC P0192, GO to DD5. For DTC P0193, GO to DD7.
No	GO to Pinpoint Test C.

DD5 INDUCE A HIGH VOLTAGE ON THE FRPT CIRCUIT

- Key in OFF position.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
VREF - Pin 2	FRP - Pin 1

- Key ON, engine OFF.
- Access the PCM and monitor the FRP PID.

Is the voltage greater than 4.5 V?

Yes	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test HC. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. CLEAR the DTCs. REPEAT the self-test.
No	GO to DD6.

DD6 CHECK THE FRP CIRCUIT FOR A SHORT TO FRT, SIGRTN, AND GND IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRP	SIGRTN
FRP	FRT

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
FRP	Ground

Is the resistance greater than 10K ohms?

Yes	GO to DD28.
No	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD7 CHECK THE FRP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
FRP	FRP - Pin 1

Is the resistance less than 5 ohms?

Yes	GO to DD8.
No	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DD8 CHECK THE FRP CIRCUIT FOR A SHORT TO VREF AND FRT IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRP	VREF
FRP	FRT

Are the resistances greater than 10K ohms?

Yes	GO to DD9.
No	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD9 CHECK THE FRP CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-)
FRP - Pin 1	Ground

Is any voltage present?

Yes	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.
No	GO to DD10.

DD10 INDUCE A LOW VOLTAGE ON THE FRPT CIRCUIT

- Key in OFF position.
- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
FRP - Pin 1	SIGRTN - Pin 4

- Key ON, engine OFF.
- Access the PCM and monitor the FRP PID.

Is the voltage less than 0.01 V?

Yes	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test HC. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. CLEAR the DTCs. REPEAT the self-test.
No	GO to DD28.

DD11 DTC P0191: CHECK FOR FUEL PUMP DTCS

- Carry out the self-test.

Are DTCs P1233, P1234, P1235, P1236, P1237 or P1238 present?

Yes	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Descriptions.
No	GO to DD12.

DD12 INSPECT ALL THE VACUUM HOSES CONNECTED TO THE INTAKE MANIFOLD FOR LEAKS

- Key in OFF position.
- FRPT Sensor connector connected.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Inspect all the vacuum hoses connected to the intake manifold for leaks.

Are any vacuum hose concerns present?

Yes	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.
No	GO to DD13.

DD13 CHECK THE FRPT CONNECTOR FOR DAMAGE OR CORROSION

- Key in OFF position.
- FRPT Sensor connector disconnected.
- Inspect the sensor, wiring, and connector for damage, corrosion, or water intrusion.

Is a concern present?

Yes	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.
No	GO to DD14.

DD14 CHECK THE FRP PID

Note: *The fuel pressure is likely to increase after the fuel pressure is relieved with the system closed. The rate and amount of the fuel pressure increase is dependent upon the ambient air and fuel temperatures.*

Note: *Prepare to record the FRP PID value within 5 seconds after the engine is shut off and also after the fuel pressure is relieved.*

- FRPT Sensor connector connected.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the FRP PID.

- Key in OFF position.
- Key ON, engine OFF.
- Record the FRP PID value within 5 seconds of the key off.
- Relieve the fuel pressure. Refer to the Workshop Manual Section 310-00, Fuel System for the Fuel System Pressure Release procedure.
- Disable the fuel pump.
- Key ON, engine OFF.
- Record the FRP PID value within 5 seconds of carrying out the fuel system pressure release procedure.

Is the difference between the recorded FRP PID values greater than 34 kPa (5 psi)?

Yes	GO to Pinpoint Test HC.
No	GO to DD15.

DD15 COMPARE THE FRP PID TO THE MECHANICAL GAUGE

Note: *Most mechanical gauges are referenced to atmospheric pressure. The FRPT sensor is referenced to manifold pressure. In order to make a valid comparison, the engine must be off.*

Note: *The vehicle may exhibit a long crank until the fuel system is pressurized.*

- Key in OFF position.
- Connect a mechanical fuel pressure gauge.
- Key ON, engine OFF.
- Monitor the mechanical gauge.
- Access the PCM and monitor the FRP PID.
- Compare the FRP PID value to the mechanical gauge.
- Key in OFF position.
- Pressurize the fuel system. Refer to the Workshop Manual Section 310-00, Fuel System for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Key ON, engine running.
- Allow the fuel pressure to stabilize.
- Key in OFF position.
- Key ON, engine OFF.
- Compare the FRP PID value to the mechanical gauge.

Are the FRP PID values within 34 kPa (5 psi) of the mechanical gauge readings?

Yes	GO to DD28.
No	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test HC. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. CLEAR the DTCs. REPEAT the self-test.

DD16 CONTINUOUS MEMORY DTCS P0192 AND P0193: CHECK THE FRPT CIRCUIT FOR AN INTERMITTENT CONCERN

Note: *Repair any fuel pump DTCs prior to this test.*

- Key ON, engine OFF.
- Access the PCM and monitor the FRP PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
  - Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM
- Check the FRPT connector for damage or corrosion.

Is a concern present?

Yes	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.
No	GO to Pinpoint Test Z.

DD17 KOEO AND KOER DTCS P0182 OR P0183: CHECK THE RESISTANCE OF THE FRPT SENSOR

- Key in OFF position.
- FRPT Sensor connector disconnected.
- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	(-) FRPT Sensor Connector, Component Side
FRT - Pin 3	SIGRTN - Pin 4

Is the resistance between 2K - 96K ohms?

Yes	GO to DD18.
No	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test HC. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. CLEAR the DTCs. REPEAT the self-test.

DD18 CHECK THE FRPT FOR INTERNAL SHORTS

- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	(-)
FRT - Pin 3	Ground

- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	(-) FRPT Sensor Connector, Component Side
FRT - Pin 3	FRP - Pin 1
FRT - Pin 3	VREF - Pin 2

Are the resistances greater than 10K ohms?

Yes	For DTC P0182, GO to DD19. For DTC P0183, GO to DD21.
No	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test HC. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. CLEAR the DTCs. REPEAT the self-test.

DD19 CHECK THE FRT CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
FRT	Ground

Is the resistance greater than 10K ohms?

Yes	GO to DD20.
No	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD20 FRPT SENSOR: INDUCE A HIGH VOLTAGE ON THE FRT CIRCUIT

- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the FRT PID.

Is the voltage greater than 4.5 V?

Yes	Unable to duplicate or identify the concern at this time. GO to Pinpoint Test Z.
No	GO to DD28.

DD21 CHECK THE FRT AND SIG RTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
FRT	FRT - Pin 3
SIGRTN	SIGRTN - Pin 4

Are the resistances less than 5 ohms?

Yes	GO to DD22.
No	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DD22 CHECK THE FRT SIGNAL FOR A SHORT TO VREF AND FRP
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRT	VREF
FRT	FRP

Are the resistances greater than 10K ohms?

Yes	GO to DD23.
No	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD23 FOR THE FRPT SENSOR INDUCE A LOW VOLTAGE ON THE FRT CIRCUIT
- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
FRT - Pin 3	SIGRTN - Pin 4

- Key ON, engine OFF.
- Access the PCM and monitor the FRT PID.

Is the voltage less than 0.2 V?

Yes	Unable to duplicate or identify the concern at this time. GO to Pinpoint Test Z.
No	GO to DD28.

DD24 DTC P0180: CHECK FOR THE PRESENCE OF DTC P0182 OR P0183
- Key ON, engine OFF.
- Carry out the self-test.

Are DTCs P0182 or P0183 present?

Yes	GO to DD17.
No	GO to DD25.

DD25 CHECK THE FRT CIRCUIT FOR AN INTERMITTENT CONCERN
- PCM connector connected.
- Access the PCM and monitor the FRT PID.
- Carry out a thorough wiggle test on the FRPT sensor harness.

Is the FRT signal stable?

Yes	GO to DD27.
No	ISOLATE the concern and REPAIR as necessary.

	CLEAR the DTCs. REPEAT the self-test.

DD26 KOEO AND KOER DTC P0181: CHECK THE FRT PID

Note: *Allow vehicle temperatures to stabilize prior to temperature sensor tests.*

- Key ON, engine OFF.
- The normal test range is 0°C to 100°C (32°F to 212°F).
- Access the PCM and monitor the FRT PID.

Is the voltage between 0.4 - 4.5 V?

Yes	GO to DD27.
No	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Descriptions.

DD27 COMPARE THE PIDS AFTER STABILIZING THE VEHICLE TEMPERATURE

- Access the PCM and monitor the FRT, CHT and ECT PIDs.

Are the temperature PIDs nearly equal in value?

Yes	The concern is not present at this time. CLEAR the DTCs. REPEAT the self-test.
No	GO to Pinpoint Test Z.

DD28 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new PCM. REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM), Programming the VID Block for a Replacement PCM.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.