Computers and Control Systems: Pinpoint Tests
Test C: Reference Voltage
PINPOINT TEST C: REFERENCE VOLTAGE

Reference Voltage	C

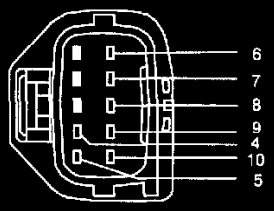
⚠ **WARNING: Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to Fire Suppression System for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- accelerator pedal position (APP) sensor (9F836)
- air conditioning pressure (ACP) sensor (19D594)
- differential pressure feedback EGR (DPFE) sensor (9J460)
- EGR system module (ESM) (9Y456)
- fuel rail pressure (FRP) sensor (6B288)
- fuel rail pressure temperature (FRPT) sensor (9G756)
- manifold absolute pressure (MAP) sensor (9F479)
- power steering pressure (PSP) sensor (3N824)
- powertrain control module (PCM) (12A650)
- throttle position (TP) sensor (9B989)

Accelerator Pedal Position (APP) Sensor Connector

A



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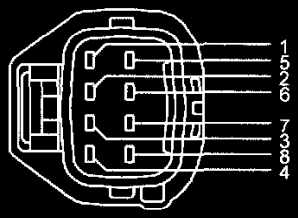

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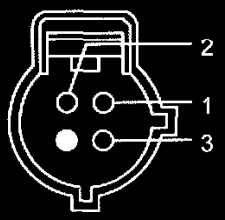
Warning And Accelerator Pedal Position (APP) Sensor Connector

Reference Voltage	C

Vehicle	Connector	Pin	Circuit
Fusion, Milan, Zephyr	A	6, 9 10, 8	ETCRTN ETCREF
All other vehicles	B	1, 3 6, 7	ETCRTN ETCREF

Air Conditioning Pressure (ACP) Sensor Connector



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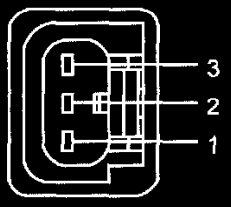
Pin	Circuit
1	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

Accelerator Pedal Position (APP) Sensor Connector And Air Conditioning Pressure (ACP) Sensor Connector

Reference Voltage	C

Differential Pressure Feedback EGR (DPFEGR) Sensor Connector

A



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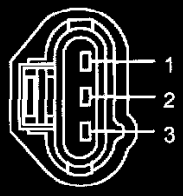
B



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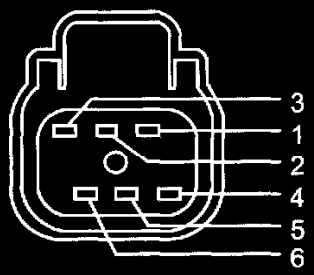
Vehicle	Connector	Pin	Circuit
Vehicles equipped with a tube mounted *DPFE sensor*	A	1 2	VREF SIGRTN
All other vehicles	B	3 2	VREF SIGRTN

EGR System Module (ESM) Connector



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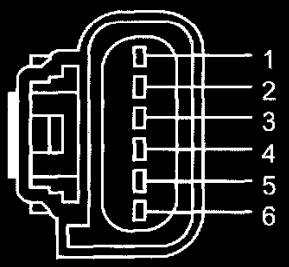
Differential Pressure Feedback EGR (DPFEGR) Sensor Connector And EGR System Module (ESM) Connector

Reference Voltage	C

Pin	Circuit
6	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector

A



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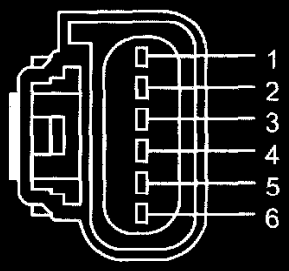

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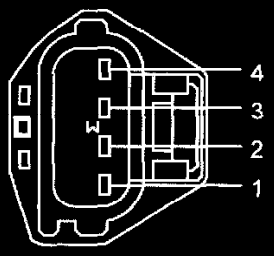

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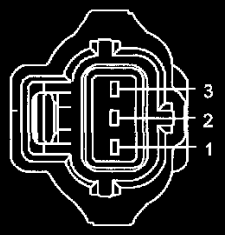
EGR System Module (ESM) Connector And Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector

Reference Voltage	C

Vehicle	Connector	Pin	Circuit
F-150 4.2L	A	2 3	ETCRTN ETCREF
Five Hundred, Freestyle, Fusion 3.0L, Milan 3.0L, Montego, Zephyr	B	4 5	ETCRTN ETCREF
Fusion 2.3L, Milan 2.3L	B	3 5	ETCRTN ETCREF
All other vehicles	C	3 2	ETCRTN ETCREF

Fuel Rail Pressure (FRP) Sensor Connector



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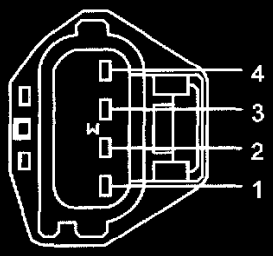
Pin	Circuit
2	SIGRTN (Signal Return)
1	VREF (Reference Voltage)

Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector And Fuel Rail Pressure (FRP) Sensor Connector

Reference Voltage	C

Fuel Rail Pressure Temperature (FRPT) Sensor Connector



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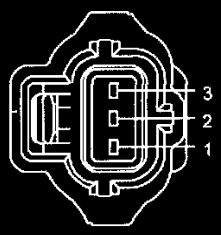
Pin	Circuit
2	VREF (Reference Voltage)
4	SIGRTN (Signal Return)

Fuel Tank Pressure (FTP) Sensor Connector

A



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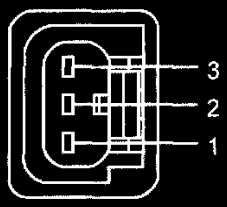

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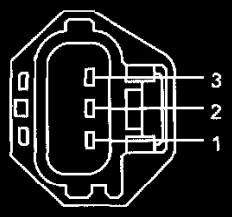
Fuel Rail Pressure Temperature (FRPT) Sensor Connector And Fuel Tank Pressure (FTP) Sensor Connector

Reference Voltage	C

Vehicle	Connector	Pin	Circuit
E-Series tank design, F-Super Duty tank design, Taurus	A	1 2	VREF SIGRTN
All other vehicles	B	1 2	VREF SIGRTN

Manifold Absolute Pressure (MAP) Sensor Connector

A



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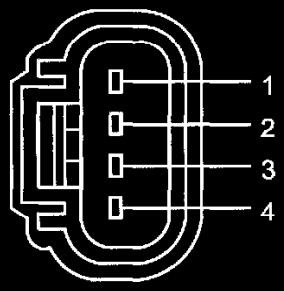
B



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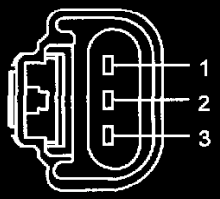
C



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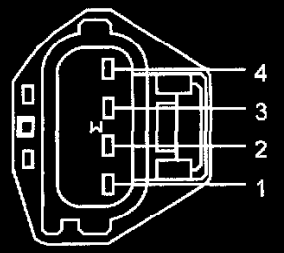

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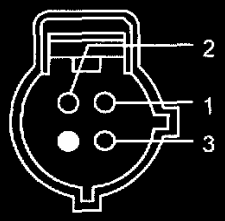
Fuel Tank Pressure (FTP) Sensor Connector And Manifold Absolute Pressure (MAP) Sensor Connector

Reference Voltage	C

Vehicle	Connector	Pin	Circuit
Escape 3.0L	A	3 1	SIGRTN VREF
Ford GT	B	4 2	SIGRTN VREF
Fusion 3.0L, Milan 3.0L, Zephyr	C	2 3	SIGRTN VREF
All other vehicles	D	4 2	SIGRTN VREF

Power Steering Pressure (PSP) Sensor Connector



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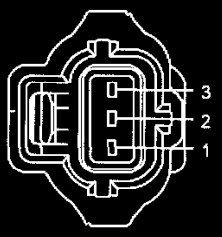
Pin	Circuit
2	VREF (Reference Voltage)
1	SIGRTN (Signal Return)

Manifold Absolute Pressure (MAP) Sensor Connector And Power Steering Pressure (PSP) Sensor Connector

Reference Voltage	C

Throttle Position (TP) Sensor Connector

A



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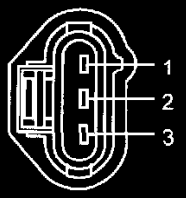

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Vehicle	Connector	Pin	Circuit
Escape 2.3L, Focus, Mariner 2.3L, Ranger 2.3L	A	3 1	VREF SIGRTN
All other vehicles	B	1 3	VREF SIGRTN

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to Reference Values.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	150 (50-50-50) Pin	B35, B36 B41, E41, T41 B41, B6, E7 B40, E40 B24, B4, E18	VPWR SIGRTN ETCRTN VREF ETCREF
E-Series 4.6L, E-Series 5.4L	170 Pin	B35, B36 B41, E58, T41 B18, B6, E59 B40, E57 B16, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF

(Continued)

Throttle Position (TP) Sensor Connector And Powertrain Control Module (PCM) Connector

Reference Voltage

C

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, F-Super Duty	170 Pin	B35, B36, T39 B41, E58, T41 B18, B6, E59 B40, E57 B16, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Escape, Mariner	150 (50-50-50) Pin	B35, B36 B41, E41, T41 B40, E40	VPWR SIGRTN VREF
Expedition, F-150, Mark LT	190 Pin	B51, B52, B53 B58, E58, T43 B58, B59, E59 B29, E57 B21, B28, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Explorer, Mountaineer	170 Pin	B35, B36 B41, E58, T41 B43, B6, E59 E57 B24, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Five Hundred, Freestyle, Montego	150 (50-50-50) Pin	B35, B36 B41, E41 B41, B6, E7 B40, E40 B24, B4, E18	VPWR SIGRTN ETCRTN VREF ETCREF
Focus	150 (50-50-50) Pin	B35, B36 B41, E41, T41 E40	VPWR SIGRTN VREF
Fusion, Milan, Zephyr	140 Pin	B51, B52 B58, E58 B59, B60, E59 B33, E57 B21, B28, E66	VPWR SIGRTN ETCRTN VREF ETCREF
LS	150 (60-32-58) Pin	B32, B33 B5, E17, T14 B17, B5, E15 B55, E14 B20, B23, E24	VPWR SIGRTN ETCRTN VREF ETCREF
Mustang	170 Pin	B35, B36 B43, E58, T41 B43, B6, E59 B40, E57 B24, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Navigator	190 Pin	B51, B52, B53 B58, E58 B58, B59, E59 B29, E57 B21, B28, E66	VPWR SIGRTN ETCRTN VREF ETCREF
All other vehicles	104 Pin	71, 97 91 90	VPWR SIGRTN VREF

Powertrain Control Module (PCM) Connector

Reference Voltage — C

SENSORS CONNECTED TO VREF/ETCREF

Applications	TP or ETC Note 2	APPS Note 2	DPFEGR or ESM	FTP	ACP	PSPT	FRP or FRPT	MAP
Crown Victoria/Grand Marquis	ETC	X	ESM	X	X		X	
Escape/Mariner - 2.3L	TP			X			X	X
Escape/Mariner - 3.0L	TP		DPFEGR	X			X	X
E-Series - 4.6L	ETC	X	ESM	X			X	
E-Series - 5.4L	ETC	X	DPFEGR	X			X	
E-Series - 6.8L	ETC	X		X			X	
Expedition/Navigator	ETC	X		X			X	
Explorer/Mountaineer	ETC	X	ESM	X			X	
F-150 - 4.2L	ETC	X	ESM	X			X	
F-150 - 4.6L	ETC	X	ESM	X		X	X	
F-150 - 5.4L/Mark LT	ETC	X		X		X	X	
F-Super Duty	ETC	X		X			X	
Focus	TP					X	X	X
Ford GT	TP		ESM	X			X	X
Freestar/Monterey	TP		ESM	X	X			
Freestyle/Five Hundred/Montego	ETC	X	ESM	X			X	
Fusion/Milan/Zephyr	ETC	X		X	X			X
LS	ETC	X	ESM	X	X		X	
Mustang - 4.0L	ETC	X	ESM	X	X		X	
Mustang - 4.6L	ETC	X		X			X	
Ranger - 2.3L	TP			X				X
Ranger - 3.0L	TP			X				
Ranger - 4.0L	TP		DPFEGR	X				
Taurus	TP		DPFEGR	X			X	
Town Car	ETC	X	ESM	X	X		X	

Note:

(1) Green State emission regulations.

(2) ETCREF and ETCRTN are internally bussed within the PCM and are dedicated circuits for the APP sensor and the electronic throttle body TP sensor only. Refer to Vehicle/Diagrams for schematic and connector information.

Chart

Reference Voltage

C

Test Step	Results / Action to Take
C1 CHECK THE REFERENCE VOLTAGE TO SIGRTN/ETCRTN • Key in OFF position. • Disconnect the suspect sensor. • Key ON, engine OFF. • For ETCREF concerns. • Measure the voltage between: (+) Suspect Sensor Connector, Harness Side: ETCREF (-) Suspect Sensor Connector, Harness Side: ETCRTN • For VREF concerns. • Measure the voltage between: (+) Suspect Sensor Connector, Harness Side: VREF (-) Suspect Sensor Connector, Harness Side: SIGRTN • **Is the voltage between 4.5 volts - 5.5 volts?**	**Yes** GO to **C19.** **No** GO to **C2.**
C2 CHECK THE REFERENCE VOLTAGE TO GROUND • For ETCREF concerns. • Measure the voltage between: (+) Suspect Sensor Connector, Harness Side: ETCREF (-): Ground • For VREF concerns. • Measure the voltage between: (+) Suspect Sensor Connector, Harness Side: VREF (-): Ground • **Is the voltage between 4.5 volts - 5.5 volts?**	**Yes** GO to **C18.** **No** GO to **C3.**

Reference Voltage — C

Test Step		Results / Action to Take
C3	**CHECK THE REFERENCE VOLTAGE WITH ALL SENSORS DISCONNECTED**	
	Note: Refer to the Sensors Connected to VREF/ETCREF Chart at the beginning of this pinpoint test and Vehicle/Diagrams to identify the sensors connected to VREF/ETCREF. • Key in OFF position. • Disconnect all of the sensors connected to the VREF/ETCREF circuit. • Key ON, engine OFF. • Measure the voltage at the sensor disconnected in C1. • For ETCREF concerns. • Measure the voltage between: **(+) Suspect Sensor Connector, Harness Side** / **(-)**: ETCREF / Ground • For VREF concerns. • Measure the voltage between: **(+) Suspect Sensor Connector, Harness Side** / **(-)**: VREF / Ground • **Is the voltage between 4.5 volts - 5.5 volts?**	**Yes** For electronic throttle control (ETC) concerns, GO to **C8**. For all other VREF concerns, GO to **C10**. **No** GO to **C4**.
C4	**CHECK THE REFERENCE VOLTAGE CIRCUIT FOR AN OPEN**	
	• Key in OFF position. • Disconnect the PCM. • For ETCREF concerns. • Measure the resistance between: **(+) Suspect Sensor Connector, Harness Side** / **(-) PCM Connector, Harness Side**: ETCREF / ETCREF • For VREF concerns. • Measure the resistance between: **(+) Suspect Sensor Connector, Harness Side** / **(-) PCM Connector, Harness Side**: VREF / VREF • **Is the resistance less than 5 ohms?**	**Yes** GO to **C5**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Reference Voltage — C

Test Step		Results / Action to Take
C5	**CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO GROUND** • For ETCREF concerns. • Measure the resistance between: (+) PCM Connector, Harness Side: ETCREF (-) PCM Connector, Harness Side: ETCRTN • Measure the resistance between: (+) PCM Connector, Harness Side: ETCREF (-): Ground • For VREF concerns. • Measure the resistance between: (+) PCM Connector, Harness Side: VREF (-) PCM Connector, Harness Side: SIGRTN • Measure the resistance between: (+) PCM Connector, Harness Side: VREF (-): Ground • **Are the resistances greater than 10K ohms?**	**Yes** GO to **C6**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C6	**CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO VPWR** • For ETCREF concerns. • Measure the resistance between: (+) PCM Connector, Harness Side: ETCREF (-) PCM Connector, Harness Side: VPWR • For VREF concerns. • Measure the resistance between: (+) PCM Connector, Harness Side: VREF (-) PCM Connector, Harness Side: VPWR • **Is the resistance greater than 10K ohms?**	**Yes** GO to **C7**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Reference Voltage — C

Test Step		Results / Action to Take
C7	**CHECK THE REFERENCE VOLTAGE FOR A SHORT TO VOLTAGE**	
	• Key ON, engine OFF. • For ETCREF concerns. • Measure the voltage between: **(+) PCM Connector, Harness Side** / **(-)**: ETCREF / Ground • For VREF concerns. • Measure the voltage between: **(+) PCM Connector, Harness Side** / **(-)**: VREF / Ground • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to **C20**.
C8	**CHECK THE REFERENCE VOLTAGE WITH THE ELECTRONIC THROTTLE CONTROL CONNECTED**	
	Note: If this sensor was used for the ETCREF measurement in C3, GO to **C9**. • Key in OFF position. • Connect the electronic throttle body throttle position sensor (ETBTPS). • Key ON, engine OFF. • Measure the voltage between: **(+) Suspect Sensor Connector, Harness Side** / **(-)**: ETCREF / Ground • **Is the voltage between 4.5 - 5.5 V?**	**Yes** The concern is intermittent. GO to Pinpoint Test Z. **No** INSTALL a new ETBTPS. CLEAR the DTCs. REPEAT the self-test.
C9	**CHECK THE REFERENCE VOLTAGE WITH THE APP SENSOR CONNECTED**	
	• Key in OFF position. • Connect the APP sensor. • Key ON, engine OFF. • Measure the voltage between: **(+) Suspect Sensor Connector, Harness Side** / **(-)**: ETCREF / Ground • **Is the voltage between 4.5 - 5.5 V?**	**Yes** The concern is intermittent. GO to Pinpoint Test Z. **No** INSTALL a new APP sensor. CLEAR the DTCs. REPEAT the self-test.

Reference Voltage — C

Test Step		Results / Action to Take
C10	**CHECK THE REFERENCE VOLTAGE WITH THE TP SENSOR CONNECTED** **Note:** If this sensor was used for the VREF measurement in C3, GO to **C11**. • Key in OFF position. • Connect the TP sensor. • Key ON, engine OFF. • Measure the voltage between: (+) Suspect Sensor Connector, Harness Side: VREF (-): Ground • **Is the voltage between 4.5 - 5.5 V?**	**Yes** For additional sensors disconnected, GO to **C11**. For no additional sensors disconnected, GO to Pinpoint Test Z. **No** INSTALL a new TP sensor. CLEAR the DTCs. REPEAT the self-test.
C11	**CHECK THE REFERENCE VOLTAGE WITH THE DPFEGR SENSOR CONNECTED** **Note:** If the vehicle is not equipped with a DPFEGR sensor or if this sensor was used for the VREF measurement in C3, GO to **C12**. • Key in OFF position. • Connect the DPFEGR sensor. • Key ON, engine OFF. • Measure the voltage between: (+) Suspect Sensor Connector, Harness Side: VREF (-): Ground • **Is the voltage between 4.5 - 5.5 V?**	**Yes** For additional sensors disconnected, GO to **C12**. For no additional sensors disconnected, GO to Pinpoint Test Z. **No** INSTALL a new DPFEGR sensor. CLEAR the DTCs. REPEAT the self-test.
C12	**CHECK THE REFERENCE VOLTAGE WITH THE ESM CONNECTED** **Note:** If the vehicle is not equipped with an ESM or if this sensor was used for the VREF measurement in C3, GO to **C13**. • Key in OFF position. • Connect the ESM. • Key ON, engine OFF. • Measure the voltage between: (+) Suspect Sensor Connector, Harness Side: VREF (-): Ground • **Is the voltage between 4.5 - 5.5 V?**	**Yes** For additional sensors disconnected, GO to **C13**. For no additional sensors disconnected, GO to Pinpoint Test Z. **No** INSTALL a new ESM. CLEAR the DTCs. REPEAT the self-test.

Reference Voltage — C

Test Step		Results / Action to Take
C13	**CHECK THE REFERENCE VOLTAGE WITH THE MAP SENSOR CONNECTED** **Note:** If the vehicle is not equipped with a MAP sensor or if this sensor was used for the VREF measurement in C3, GO to **C14**. • Key in OFF position. • Connect the MAP sensor. • Key ON, engine OFF. • Measure the voltage between: (+) Suspect Sensor Connector, Harness Side: VREF (-): Ground • **Is the voltage between 4.5 - 5.5 V?**	**Yes** For additional sensors disconnected, GO to **C14**. For no additional sensors disconnected, GO to Pinpoint Test Z. **No** INSTALL a new MAP sensor. CLEAR the DTCs. REPEAT the self-test.
C14	**CHECK THE REFERENCE VOLTAGE WITH THE FRP/FRPT SENSOR CONNECTED** **Note:** If the vehicle is not equipped with a FRP/FRPT sensor or if this sensor was used for the VREF measurement in C3, GO to **C15**. • Key in OFF position. • Connect the FRP/FRPT sensor. • Key ON, engine OFF. • Measure the voltage between: (+) Suspect Sensor Connector, Harness Side: VREF (-): Ground • **Is the voltage between 4.5 - 5.5 V?**	**Yes** For additional sensors disconnected, GO to **C15**. For no additional sensors disconnected, GO to Pinpoint Test Z. **No** INSTALL a new FRP/FRPT sensor. CLEAR the DTCs. REPEAT the self-test.
C15	**CHECK THE REFERENCE VOLTAGE WITH THE FTP SENSOR CONNECTED** **Note:** If the vehicle is not equipped with a FTP sensor or if this sensor was used for the VREF measurement in C3, GO to **C16**. • Key in OFF position. • Connect the FTP sensor. • Key ON, engine OFF. • Measure the voltage between: (+) Suspect Sensor Connector, Harness Side: VREF (-): Ground • **Is the voltage between 4.5 - 5.5 V?**	**Yes** For additional sensors disconnected, GO to **C16**. For no additional sensors disconnected, GO to Pinpoint Test Z. **No** INSTALL a new FTP sensor. CLEAR the DTCs. REPEAT the self-test.

Reference Voltage — C

Test Step	Results / Action to Take
C16 CHECK THE REFERENCE VOLTAGE WITH THE ACP CONNECTED **Note:** If the vehicle is not equipped with a ACP or if this sensor was used for the VREF measurement in C3, GO to **C17**. • Key in OFF position. • Connect the ACP. • Key ON, engine OFF. • Measure the voltage between: (+) Suspect Sensor Connector, Harness Side: VREF (-): Ground • **Is the voltage between 4.5 - 5.5 V?**	**Yes** For additional sensors disconnected, GO to **C17**. For no additional sensors disconnected, GO to Pinpoint Test Z. **No** INSTALL a new ACP sensor. CLEAR the DTCs. REPEAT the self-test.
C17 CHECK THE REFERENCE VOLTAGE WITH THE PSP SENSOR CONNECTED • Key in OFF position. • Connect the PSP sensor. • Key ON, engine OFF. • Measure the voltage between: (+) Suspect Sensor Connector, Harness Side: VREF (-): Ground • **Is the voltage between 4.5 - 5.5 V?**	**Yes** The concern is intermittent. GO to Pinpoint Test Z. **No** INSTALL a new PSP sensor. CLEAR the DTCs. REPEAT the self-test.
C18 CHECK THE SIGRTN OR ETCRTN CIRCUIT(S) FOR AN OPEN **Note:** Refer to Vehicle/Diagrams for specific vehicle application and pin locations. • Key in OFF position. • Disconnect the PCM. • For ETCRTN concerns. • Measure the resistance between: (+) Suspect Sensor Connector, Harness Side: ETCRTN (-) PCM Connector, Harness Side: ETCRTN • For SIGRTN concerns. • Measure the resistance between: (+) Suspect Sensor Connector, Harness Side: SIGRTN (-) PCM Connector, Harness Side: SIGRTN • **Is the resistance less than 5 ohms?**	**Yes** GO to **C20**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Reference Voltage	C

Test Step		Results / Action to Take
C19	**CHECK THE SUSPECT SENSOR FOR AN INTERNAL SHORT**	
	• Clear the KOEO, KOER, and continuous DTCs. • Key in OFF position. • Connect the suspect sensor. • Key ON, engine OFF. • Carry out the PCM self-test. • **Is the concern still present?**	**Yes** INSTALL a new sensor for the sensor in question. CLEAR the DTCs. REPEAT the self-test. **No** The concern is intermittent. GO to Pinpoint Test Z.
C20	**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 Diagnostic Methods, Flash Electrically Erasable Programmable Read Only Memory (EEPROM). **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.