

PCM/PIDS/SIGNALS	Associated Circuit	Test Type
O2S22	HO2S22	Input
OSS	OSS	Input
PFP11	PFP11	Input
PFP21	PFP21	Input
PTO	PTO	Input
SCIP, SCIP V	TCIP	Input
TACM (+)	TACM (+)	Output
TACM (-)	TACM (-)	Output
TCBP	TCBP	Input
TCBP_V	TCBP	Input
TP	TP	Input
TP1	TP1	Input
TP2	TP2	Input
TURBO_BP1_STAT	TCBY	Output
TURBO_BP2_STAT	TCBY2	Output
TURBO_INLET, TURBO_INLET_V	TCIP	Input
TURBO_WGATE	TCWRVS	Output
TWGATE_STAT	TCWRVS	Output
VCTADV, VCT_INT_ACT1	VCT11	Input
VCTADV2, VCT_INT_ACT2	VCT21	Input
VCT_EXH_ACT1	VCT12	Input
VCT_EXH_ACT2	VCT22	Input
VPWR	VPWR	Input
Use DMM	VREF	Output
Use DMM	VSO	Output
VSS	VSS+	Input
WGATE_A_POS_PCT	TCWGP1	Input
WGATE_B_POS_PCT	TCWGP2	Input
WGATE_PRES	WVS	Input
WGATE_V	WVS	Input

Z1 DIRECTION FOR INTERMITTENT DIAGNOSTIC PATH

Note: Proceed with this step only if the PCM DTCs and the freeze frame data have not been cleared. Record freeze frame data prior to clearing the PCM DTCs. Clearing the DTCs clears any freeze frame data and eliminates FMEM. This helps to recreate the original conditions that set the DTCs or caused the symptom.

- Ignition ON, engine OFF.
- Clear the PCM DTCs.

Are the PCM DTCs cleared?

Yes	GO to Z2 .
No	RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM) .

REPEAT the self-test.

Z2 SELECT THE PIDS AND/OR SIGNALS RELATED TO THE SYSTEM

- A list of related PIDs and/or signals are needed for use with the scan tool to monitor the suspect areas. Obtain the customer symptom description. Use the Reference Value Symptom chart and proceed to the Reference Value PID/Signal Measurement chart located at the beginning of Section 6, Reference Values.
- Highlight each available PID/signal recommended by the charts under the PID/signal selection menu on the scan tool.

Are all available PIDs/signals related to the symptom selected?

Yes	GO to Z3 .
No	REPEAT the test step. GO to Z2 .

Z3 DECISION TO VERIFY THE SYMPTOM

Note: The path to symptom verification is optional but is recommended for several reasons. For example, the vehicle is back for a repeat repair, or there is no DTC present.

Is a concern or symptom present?

Yes	GO to Z10 .
No	GO to Z4 .

Z4 COLLECT ANY SYMPTOM RELATED DATA TO AID IN VERIFICATION

Note: Only MIL codes trigger freeze frame data. Refer to the scan tool instruction manual to retrieve the freeze frame information.

- Prepare the freeze frame data for use with information from the Section 3, Symptom Charts.
- Check for continuous memory DTCs that should have been recorded from an earlier pinpoint test.
- Access the information from the customer information worksheet and the customer if available. Access any other symptom related data available, such as TSBs and OASIS reports.

Is all available data recorded?

Yes	GO to Z5 .
No	GATHER as much data as possible to aid in isolating the intermittent concern area. REPEAT the test step. GO to Z4 .

Z5 RECREATE THE SYMPTOM USING ALL AVAILABLE DATA

Note: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- With the scan tool, select and monitor the same PIDs as displayed in freeze frame along with any previously selected PIDs/signals from step Z2. Using the freeze frame data recorded earlier, recreate the conditions described by each freeze frame PID. Pay special attention to ECT, LOAD, RPM and VSS. Also, use any available data from the customer, TSBs, and other sources to aid in producing the correct conditions for recreating the symptom.
- When the symptom occurs, press the trigger to begin recording. Refer to the scan tool instruction manual for information on the recorder function.

Can the symptom be recreated?

Yes	GO to Z10 .
No	GO to Z6 .

Z6 RECREATE THE SYMPTOM

Note: PIDs for output in the Reference Value Charts represent command values only. Circuit measurements with a DMM indicate the actual output status. Therefore, in the case of a concern, the PID and circuit reading on the vehicle may not correspond with each other. PIDs for PCM circuits with a mismatch in the DMM measurement indicate a possible PCM concern.

- The road test is the last attempt to locate the area of concern before physically disturbing vehicle circuits.
- The Intermittent Road Test Procedure is a set of instructions for monitoring PIDs/signals with a scan tool and circuit measurements with a DMM. This is done under 4 different conditions - ignition on and engine off, hot idle, 48 km/h (30 mph) and 88 km/h (55 mph). Use the typical diagnostic reference values from Section 6, Reference Values to compare with the actual vehicle.
- Locate the correct reference value chart in Section 6, Reference Values.
- Setup the vehicle to measure the circuits with a DMM and a scan tool.
- Connect a scan tool to the DLC.
- Ignition ON, engine OFF.
- With the scan tool, select and monitor PIDs and measure the circuits shown in the reference value chart in Section 6, Reference Values.
- Compare the scan tool PIDs and DMM values to the reference value charts.

Are any values out of range?

Yes	GO to Z10 .
No	GO to Z7 .

Z7 RECREATE THE SYMPTOM USING THE HOT IDLE ROAD TEST

Note: The engine temperature should be at least 87°C (189°F).

- Ignition ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.

Are any values out of range?

Yes	GO to Z10 .
No	GO to Z8 .

Z8 RECREATE THE SYMPTOM DURING AN 48 KM/H (30 MPH) ROAD TEST

- Drive the vehicle on a preplanned route.
- Continue to monitor the PIDs and circuits as in the previous step.

Are any values out of range?

Yes	GO to Z10 .
No	GO to Z9 .

Z9 RECREATE THE SYMPTOM DURING AN 88 KM/H (55 MPH) ROAD TEST

- Continue to drive the vehicle on the preplanned route.
- Continue to monitor the PIDs and circuits as in the previous step.

Are any values out of range?

Yes	GO to Z10 .
No	It is now necessary to physically disturb the selected vehicle circuits in an attempt to recreate the intermittent concern. GO to Z10 .

Z10 SELECT THE CIRCUITS FROM THE PCM PIDS/SIGNALS CHART

Note: From the same chart, be sure to select and proceed with the appropriate test type.

Note: The Input Test step should be used on sensing inputs such as temperature, position or oxygen.

Note: The Output Test step should be used on output devices such as relays, coils or solenoids.

- Remain in the PID/Signal selection menu with the scan tool.
- Highlight only the PIDs/signals from step Z2.
- Proceed to the PCM PIDS/SIGNALS chart located at the beginning of this test.
- Match the selected PIDs/signals to the corresponding circuit in the chart. There may be more than one circuit to test. If a PID/signal recording was made with the scan tool, it may be helpful to replay it at this time. Refer to the scan tool instruction manual for additional information.

Has a test been chosen?

Yes	For the input test step, GO to Z11 . For the output test step, GO to Z15 .
No	RETURN to Section 3, Symptom Charts for further direction.

Z11 KOEO INPUT TEST PROCEDURE FOR THE PCM SENSORS

 **WARNING:** When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces. Failure to follow these instructions may result in personal injury.

- Using the circuits chosen from the Section 6, PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a DMM to check the value.
- Proceed to the area of the suspect wiring or component concern.
- Ignition ON, engine OFF.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM and wiggle the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the reference values in Section 6, Reference Values.

Are there abrupt changes in the PID values that do not compare with the Section 6, typical reference values?

Yes	REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.
No	GO to Z12 .

Z12 KOER INPUT TEST PROCEDURE FOR THE PCM SENSORS

 **WARNING:** When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces. Failure to follow these instructions may result in personal injury.

- Ignition ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM and wiggle the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the reference values in Section 6, Reference Values.

Are any values fluctuating in and out of range?

Yes	REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.
No	GO to Z13 .

Z13 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM SENSORS, EXCLUDING HIGH VOLTAGE CIRCUITS

⚠ WARNING: When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces. Failure to follow these instructions may result in personal injury.

- Ignition ON, engine OFF.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values in Section 6.

Are any values fluctuating in and out of range?

Yes	REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.
No	GO to Z14 .

Z14 KOER WATER SOAK TEST PROCEDURE FOR THE PCM SENSORS, EXCLUDING HIGH VOLTAGE CIRCUITS

⚠ WARNING: When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.

Failure to follow these instructions may result in personal injury.

- Ignition ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values in Section 6.

Are any values fluctuating in and out of range?

Yes	REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.
No	GO to Z15 .

Z15 KOER WIGGLE TEST PROCEDURE FOR THE PCM SENSORS

⚠ WARNING: When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces. Failure to follow these instructions may result in personal injury.

Note: Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A DMM measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur during any part of the following test. The output state test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.

- Using the circuits chosen from the PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a DMM to check the value.
- Ignition ON, engine OFF.
- With the scan tool, turn on selected outputs using output state control. Refer to the scan tool instruction manual.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM and wiggle the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the reference values in Section 6, Reference Values.

Is there a mismatch between command and actual or are any values fluctuating in and out of range when

compared to the reference value charts in Section 6, Reference Values?

Yes	REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.
No	GO to Z16 .

Z16 KOER OUTPUT TEST PROCEDURE FOR THE PCM ACTUATORS

⚠ WARNING: When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces. Failure to follow these instructions may result in personal injury.

Note: Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A DMM measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur during any part of the following test. The output state test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.

- Ignition ON, engine running.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PIDs with the scan tool and note the values. Compare the scan tool values with values from a DMM with the engine at idle.
- If a coil for a coil on plug application is suspect, turn off the ignition. Gain access to the coil and measure continuity from the spark plug terminal to the signal terminal while tapping the coil. A large fluctuation in resistance indicates an intermittent open or short.
- Monitor the PID and wiggle the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the reference values in Section 6, Reference Values.

Is there a scan tool to DMM value mismatch or an idle fluctuation?

Yes	REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.
No	GO to Z17 .

Z17 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM ACTUATORS, EXCLUDING HIGH VOLTAGE CIRCUITS

⚠ WARNING: When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces. Failure to follow these instructions may result in personal injury.

Note: Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A DMM measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur during any part of the following test. The output state test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.

- Ignition ON, engine OFF.
- With the scan tool, turn on selected outputs using output state control. Refer to the scan tool instruction manual.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Look for abrupt changes in the values. Compare these actual values to the reference values in Section 6, Reference Values.

Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the reference value charts in Section 6, Reference Values?

Yes	REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.
No	GO to Z18 .

Z18 KOER WATER SOAK TEST PROCEDURE FOR THE PCM ACTUATORS

 **WARNING:** When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.

Failure to follow these instructions may result in personal injury.

- Ignition ON, engine running.
- Using the circuits chosen from the PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a DMM to check the value.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM/TCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values in Section 6.

Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts in Section 6?

Yes	REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.
No	GO to Z19 .

Z19 INSPECT FOR INTERMITTENT MECHANICAL CONCERNS

Note: *It is possible for an intermittent mechanical concern to cause a good PCM system to react abnormally.*

- An inspection of DTC related mechanical systems should have been carried out in an earlier section. If not, visually inspect at this time.
- Look for possible vacuum lines, wires, cables, linkage or hoses that may become kinked, shorted or restricted during normal engine operation.
- This may include engine/transmission gear changes, acceleration and deceleration, rough roads and various engine RPM and torque related conditions.

Is a mechanical concern detected?

Yes	REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.
No	It is necessary to seek additional help. REFER to the Service Repair And Technical Assistance Process. A vehicle data recorder (VDR) or similar recorder may also be useful.

QB: Keep Alive Power (KAPWR)

This pinpoint test is intended to diagnose the following:

- battery terminal condition
- KAPWR wire routing
- harness circuit: KAPWR
- powertrain control module (PCM) (12A650)

Powertrain Control Module (PCM) Connector

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

Vehicle	Connector	Pin	Circuit
E-Series	198 PIN	B21	KAPWR
EcoSport	112 PIN	B10	KAPWR
Fusion 2.5L	198 PIN	B62	KAPWR
Ranger	128 PIN	B10	KAPWR
Transit	306 PIN	B100	KAPWR
All other vehicles	198 PIN	B100	KAPWR

QB1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Note: The DTC P2610 may set after a PCM reprogramming. If this DTC is retrieved after a PCM reprogramming, disregard this DTC.

- Carry out a visual inspection.
- Record the DTCs.
- Record the freeze frame data.
- Clear the PCM DTCs.
- Carry out the PCM self-test.

Are DTCs P0603, P1633 or P2610 present?

Yes	For DTC P2610, GO to QB6 . For all others, GO to QB2 .
No	Unable to duplicate the condition. CHECK for a loose connection, and damaged or corroded pins. WIGGLE the harness attempting to recreate the concern. REPAIR as necessary. REFER to Section 3, GO to Pinpoint Test QT , if a driveability concern exists. Clear the PCM DTCs. REPEAT the self-test.

QB2 CHECK THE 12-VOLT BATTERY TERMINALS

Note: If the KAPWR is interrupted to the PCM, a DTC can be generated on the first power-up.

Note: If DTC P0603 occurred right after or during an unsuccessful reprogramming of the PCM, clear the DTCs and repeat the PCM self-test. If DTC P0603 is retrieved again, continue with this pinpoint test.

- Inspect the 12 volt battery cables for loose connections and for corrosion.

Are the 12 volt battery terminal connections in good condition?

Yes	GO to QB3 .
No	REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.

QB3 INSPECT THE ENGINE COMPARTMENT FOR CORRECT WIRE ROUTING

- Inspect the electronic engine control (EEC) system wiring for correct wire routing.
- Check the wiring routing to establish if any of the electrical connectors are being stressed due to incorrectly routed wiring. If necessary re-route and secure the wiring.
- Visually inspect the wiring and connectors.

Is a concern present?

Yes	REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.
No	For E-Series, Ford GT, Motorhome / Stripped Chassis / Step Van, and Ranger 2.5L, GO to QB4 . For all others, GO to QB5 .

QB4 CHECK KAPWR TO THE PCM

- Ignition OFF.
- PCM connector disconnected.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
KAPWR	Negative terminal

Is the voltage greater than 10.5 V?

Yes	GO to QB5 .
No	ISOLATE the concern and REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.

QB5 CHECK FOR A REOCCURRENCE OF THE DTC

- PCM connector connected.
- Clear the PCM DTCs.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Carry out the PCM self-test.

Is DTC P0603 or P1633 present?

Yes	GO to QB8 .
No	Unable to duplicate or identify the concern at this time. GO to Pinpoint Test Z .