

## Computers and Control Systems: Pinpoint Tests

### Test DA: Intake Air Temp. (IAT)/Engine Coolant Temp. (ECT) Sensors

**DA: Intake Air Temperature (IAT)/Engine Coolant Temperature (ECT)/Engine Oil Temperature (EOT) Sensors**

**DA**

#### Introduction

#### Note

This Pinpoint Test is intended to diagnose the following:

- Intake air temperature (IAT) sensor (12A697)
- Integrated intake air temperature (IAT) sensor (12B579)
- Engine coolant temperature (ECT) sensor (12A648)
- Engine oil temperature (EOT) sensor (12A648)
- Harness circuits: IAT, ECT, EOT and SIG RTN
- Powertrain control module (PCM) (12A650)

The term "applicable" is used in this pinpoint test and refers to the temperature sensor indicated by the DTC. Example: ECTV, IATV, EOTV.

#### Tables and Graphs

**Note:** Engine coolant temperature must be greater than 10°C (50°F) to pass the KOEO Self-Test and greater than 82°C (180°F) to pass the KOER Self-Test. To accomplish this, the engine must be at normal operating temperature.

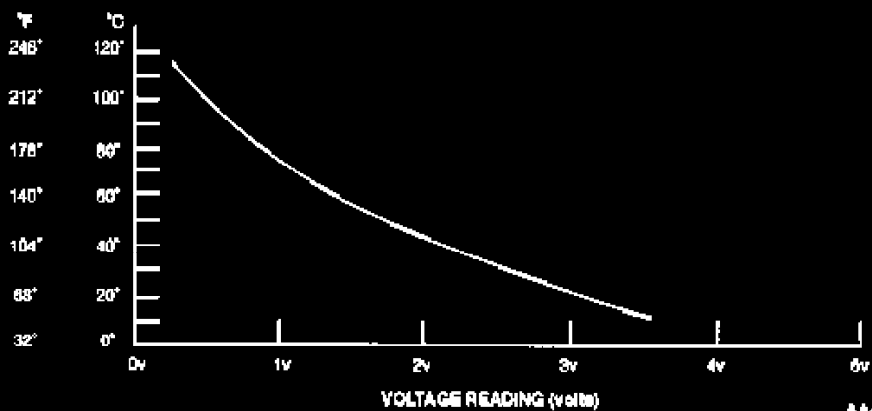
Ambient temperature must be above 10°C (50°F) to receive acceptable input from the intake air temperature (IAT) sensor.

Engine oil temperature must be greater than 10°C (50°F) to pass the KOEO Self-Test and greater than 66°C (150°F) to pass the KOER Self-Test.

Voltage values were calculated for VREF = 5.0 volts. These values can vary 15 percent due to sensor and VREF variations.

#### DA INTRODUCTION

**TEMPERATURE**



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**TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS**

Temperature		Temperature Sensor Values		
°C	°F	Voltage (volts)		Resistance
		Focus	All Others	K ohms
120	248	0.28	0.27	1.18
110	230	0.36	0.35	1.55
100	212	0.47	0.46	2.07
90	194	0.61	0.60	2.80
80	176	0.80	0.78	3.84
70	158	1.05	1.02	5.37
60	140	1.37	1.33	7.70
50	122	1.77	1.70	10.97
40	104	2.23	2.13	16.15
30	86	2.74	2.60	24.27
20	68	3.26	3.07	37.30
10	50	3.73	3.51	58.75
0	32	4.14	3.91	95.85
-10	14	4.45	4.15	160.31

### Pinpoint Test Schematics and Connectors

ENGINE COOLANT TEMPERATURE (ECT) HARNESS CONNECTOR



PCM PIN 91  — SIG RTN  
(4.0L EXPLORER/MOUNTAINEER  
150 PIN; PCM PIN A17)

PCM PIN 38  — ECT  
(4.0L EXPLORER/MOUNTAINEER  
150 PIN; PCM PIN C46)

NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

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### LS6/LS8 (If equipped)

ENGINE OIL TEMPERATURE (EOT) HARNESS CONNECTOR

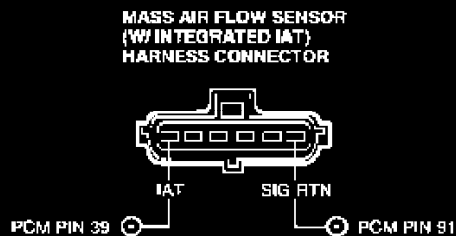


PCM PIN C-17  — SIG RTN  
PCM PIN C-39  — EOT

NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE A0015120

## Focus, 2.0L Cougar

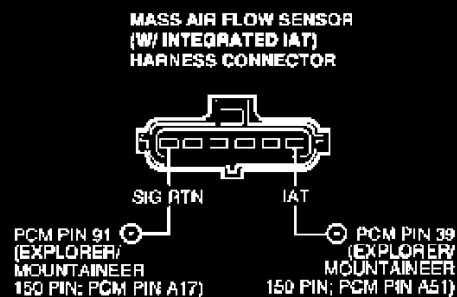
**Note:** On some applications the integrated IAT/MAF sensor connector is located inside the air cleaner assembly.



**NOTE: ALL HARNESS CONNECTORS ARE  
VIEWED INTO MATING SURFACE**      A0013832

Escort 4V, Taurus/Sable, FF Taurus, 3.8L Mustang, Windstar, 2.3L/3.0L/4.0L Ranger, Escape, Explorer/Mountaineer, Explorer Sport/Sport Trac, Econoline, Excursion, 5.4L/6.8L F250/F350/F450

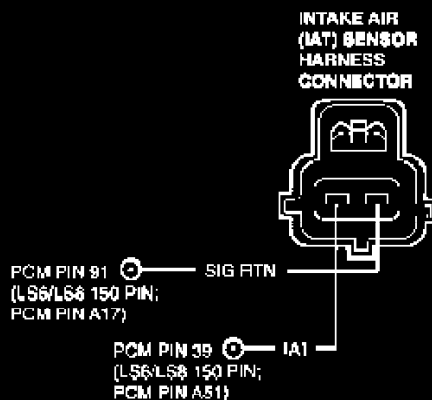
**Note:** On some applications the integrated IAT/MAF sensor connector is located inside the air cleaner assembly.



**NOTE: ALL HARNESS CONNECTORS ARE  
VIEWED INTO MATING SURFACE**

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## All Others



**NOTE: ALL HARNESS CONNECTORS ARE  
VIEWED INTO MATING SURFACE**

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## DA: Intake Air Temperature (IAT)/Engine Coolant Temperature (ECT)/Engine Oil Temperature (EOT) Sensors

DA

### DA1 DTC P1116: CHECK OPERATION OF ECT SENSOR

- Run engine at 2000 rpm until engine temperature becomes stabilized.
- **No Starts:**
  - GO to DA3 .
- **Vehicles that stall:**
  - Return to Symptom Charts.
- Check that upper radiator hose is hot and pressurized.
- Rerun Key On Engine Running (KOER) Self-Test.

#### Is DTC P1116 present?

Yes	No
KEY OFF. GO to DA2 .	Engine was not at closed loop operating conditions. REPAIR any other DTCs as necessary.

### DA2 CHECK VREF VOLTAGE TO TP SENSOR

- Disconnect throttle position (TP) sensor.

**Note:** GO to Pinpoint Test DH and refer to **Pinpoint Test Schematics and Connectors** for TP harness connector pin-out information.

- Key on, engine off.
- Measure the voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

#### Is voltage between 4.0 volts and 6.0 volts?

Yes	No
There is sufficient VREF voltage. RECONNECT TP sensor. GO to DA3 .	GO to C1 .

DA1 - DA2

## DA3 CHECK TEMPERATURE SENSOR RESISTANCE WITH ENGINE OFF

- Disconnect ECT sensor.
- Measure ECT sensor resistance. Refer to the chart at the beginning of this Pinpoint Test for resistance specifications.

### Is resistance within specification?

Yes	No
<p><b>For ECT sensor with a No Start:</b></p> <p>Do not repair DTC P1116 at this time. RETURN to Symptom Charts.</p> <p>For symptoms of cooling fan concerns, overheating and lack of heat, do not repair DTC P1116. REPAIR next DTC. If no other DTC exists, RETURN to Symptom Charts.</p> <p><b>All others:</b></p> <p>GO to DA4 .</p>	<p>REPLACE suspect sensor.</p>

## DA4 CHECK TEMPERATURE SENSOR RESISTANCE WITH ENGINE RUNNING

**Note:** Verify that engine is at operating temperature before taking ECT readings.

- Run engine for two minutes at 2000 rpm.
- Measure temperature sensor resistance. Refer to the chart at the beginning of this Pinpoint Test for resistance specifications.

### Is resistance within specification?

Yes	No
<p>REPLACE PCM ( Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). RESTORE vehicle.</p>	<p>REPLACE suspect sensor.</p>

## DA10 DTC P0118 OR P0113: CHECK VOLTAGE BETWEEN VREF AND SIG RTN

- Disconnect throttle position (TP) sensor.

**Note:** GO to Pinpoint Test DH and refer to **Pinpoint Test Schematics and Connectors** for TP harness connector pin-out information.

- Key on, engine off.
- Measure the voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

**Is voltage between 4.0 volts and 6.0 volts?**

Yes	No
GO to DA11 .	GO to C1 .

## DA11 SIMULATE OPPOSITE SIGNAL TO PCM

- With applicable temperature sensor disconnected, connect a jumper wire between the sensor signal and SIG RTN circuits at the temperature sensor harness connector.
- Key on.

**Note:** If a scan tool communication concern exists, remove jumper wire immediately and GO to DA13 .

- Access applicable temperature sensor voltage PID.

**Is the applicable temperature sensor voltage PID less than 0.2 volts (greater than 120°C/248°F)?**

Yes	No
REPLACE suspect sensor.	REMOVE jumper wire. GO to DA12 . KEY OFF.

DA10 - DA11

## DA12 CHECK TEMPERATURE SENSOR SIGNAL AND SIG RTN CIRCUITS FOR OPEN IN HARNESS

**Note:** Refer to the PCM connector pin numbers on this pinpoint test cover page.

- Disconnect PCM.
- Measure resistance of sensor signal circuit between PCM harness connector pin and applicable sensor harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector pin and applicable temperature sensor harness connector.

**Is each resistance less than 5.0 ohms?**

Yes	No
REPLACE PCM.	REPAIR open circuits.

## DA13 CHECK TEMPERATURE SENSOR SIGNAL FOR SHORT TO VREF IN HARNESS

- Key off.
- Disconnect PCM.
- Measure resistance between applicable temperature sensor signal and VREF circuits at the PCM harness connector.

**Is resistance greater than 10,000 ohms?**

Yes	No
REPLACE PCM (Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short to VREF.

## DA20 DTC P0112 OR P0117: SIMULATE OPPOSITE SIGNAL TO PCM

- Disconnect harness from applicable temperature sensor.
- Connect scan tool.
- Key on.
- Access applicable temperature sensor voltage PID.

**Is the applicable temperature sensor voltage PID greater than 4.2 volts (less than -40°C/-40°F)?**

Yes	No
REPLACE sensor.	GO to DA21 .

## DA21 CHECK VREF VOLTAGE TO TP SENSOR

- Disconnect throttle position (TP) sensor.

**Note:** GO to Pinpoint Test DH and refer to **Pinpoint Test Schematics and Connectors** for TP harness connector pin-out information.

- Key on, engine off.
- Measure the voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

### Is voltage between 4.0 and 6.0 volts?

Yes	No
There is sufficient VREF voltage. RECONNECT TP sensor. GO to DA22. KEY OFF.	GO to C1.

## DA22 CHECK TEMPERATURE SIGNAL CIRCUIT FOR SHORT TO GROUND IN HARNESS

**Note:** Refer to the PCM connector pin numbers on this pinpoint test cover page.

- Disconnect PCM.
- Measure resistance between sensor signal and SIG RTN circuits and then between sensor signal and PWR GND circuits at the PCM harness connector.

### Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

## DA80 P0116: CHECK TEMPERATURE SENSOR RESISTANCE WITH ENGINE OFF

**Note:** Verify that engine temperature is at ambient room temperature before continuing with this test. A soak period of 6 hours may be required. Refer to Diagnostic Trouble Code (DTC) Descriptions for information concerning P0116.

- Key on, engine off.
- Disconnect ECT sensor.
- Measure ECT sensor resistance. Refer to the chart at the beginning of this Pinpoint Test for resistance specifications.

### Is resistance within specification?

Yes	No
GO to DA81 .	REPLACE suspect sensor.

## DA81 P0116: CHECK TEMPERATURE SENSOR RESISTANCE WITH ENGINE RUNNING

**Note:** Verify that engine is at operating temperature before taking ECT readings.

- Run engine for two minutes at 2000 rpm.
- Measure temperature sensor resistance. Refer to the chart at the beginning of this Pinpoint Test for resistance specifications.

### Is resistance within specification?

Yes	No
Fault is not present at this time. COMPLETE OBDII Drive Cycle to determine if Fuel, HEGO, Catalyst and Misfire monitors can be executed (REFER to Drive Cycles). Retest if necessary.	REPLACE suspect sensor.

DA80 - DA81

## DA90 DTCS P0112, P1112, P0113, P0117, P1117 OR P0118: INTERMITTENT CHECK

- Connect scan tool.
- Key on.
- Monitor the applicable temperature sensor voltage PID.
- While observing the PID, complete the following:
  - Tap on the sensor to simulate road shock.
  - Wiggle the sensor connector.

### Is there any large change in the voltage reading?

Yes	No
Key OFF. DISCONNECT and INSPECT connectors. If OK, REPLACE the sensor. For Continuous DTCs P1112 and P1117, COMPLETE OBDII Drive Cycle to verify repair (REFER to Drive Cycles).	GO to DA91 .

## DA91 CHECK ELECTRONIC ENGINE CONTROL (EC) WIRING HARNESS

- Still monitoring PID.
- While observing the appropriate PID, complete the following:
  - Hold the sensor harness close to the sensor connector. Wiggle, shake and bend small sections of wiring harness while working toward the PCM.

### Is there any change in the voltage reading?

Yes	No
ISOLATE fault. REPAIR as necessary. For Continuous DTCs P1112 and P1117, COMPLETE OBDII Drive Cycle to verify repair (REFER to Drive Cycles).	GO to DA92 .

DA90 - DA91

## DA92 CHECK PCM AND VEHICLE HARNESS CONNECTOR

- Disconnect PCM.
- Disconnect sensor connector.

### Are connectors and terminals OK?

Yes	No
Fault is not present at this time. For Continuous Memory DTCs P1112 and P1117, COMPLETE OBDII Drive Cycle (REFER to Drive Cycles).	REPAIR as necessary. For Continuous Memory DTCs P1112 or P1117, COMPLETE OBDII Drive Cycle to verify repair (REFER to Drive Cycles).

## DA100 DTC P0125: CHECK ENGINE COOLANT LEVEL

Diagnostic Trouble Code (DTC) P0125 indicates the ECT sensor has not achieved the required temperature level to enter closed loop operating conditions within a specified amount of time after starting engine. This DTC will light the MIL.

Possible causes:

- Insufficient warm up time.
- Leaky or stuck open thermostat.
- Low engine coolant level.
- Malfunctioning ECT sensor.



**WARNING: TO AVOID PERSONAL INJURY, DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE; STREAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENDED SLIGHTLY.**

- Check engine coolant level.

### Is the engine coolant level fill correct?

Yes	No
REFER to Engine Cooling for further diagnostics.	FILL engine coolant to proper level. COMPLETE OBDII Drive Cycle to verify repair (REFER to Drive Cycles).

**DA110 DTC P1184: CHECK OPERATION OF EOT TEMP SENSOR**

- Connect scan tool.
- Run engine at 2000 rpm until engine temperature becomes stabilized.
- Run Key On Engine Running (KOER) Self-Test.

**Is DTC P1184 present?**

Yes	No
GO to DA111 .	Engine oil temperature was not at operating temperature. REPAIR any other DTCs as necessary.

**DA111 DTC P1183, P1184 OR P0298: CHECK TEMPERATURE SENSOR SIGNAL**

- Connect scan tool.
- Key on.
- Access EOTV PID.

**Is EOTV PID less than 0.3 volts?**

Yes	No
GO to DA112 .	GO to DA115 .

**DA112 SIMULATE OPPOSITE EOT SIGNAL TO PCM**

- Still monitoring PID.
- Disconnect EOT sensor.

**Is EOTV PID greater than 4.2 volts?**

Yes	No
REPLACE suspect sensor.	GO to DA113 .

DA110 - DA112

## DA113 CHECK EOT SIGNAL CIRCUIT FOR SHORT TO GROUND IN HARNESS

**Note:** Refer to the PCM connector pins numbers on this pinpoint test cover page.

- Disconnect PCM.
- Measure resistance between EOT and SIG RTN circuits and then between EOT and PWR GND circuits at the PCM harness connector.

**Is each resistance greater than 10,000 ohms?**

Yes	No
REPLACE PCM (Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

## DA115 CHECK FOR HIGH EOT SIGNAL

- Still monitoring PID.

**Is EOTV PID greater than 4.2 volts?**

Yes	No
GO to DA116 .	GO to DA120 .

## DA116 SIMULATE LOW SIGNAL TO PCM

- Disconnect EOT temperature sensor.
- Connect a jumper wire between the sensor signal and SIG RTN circuits at the temperature sensor harness connector.
- Key on.
- Access EOTV PID.

**Is EOTV PID less than 0.3 volts?**

Yes	No
REPLACE suspect sensor.	KEY OFF. GO to DA117 .

DA113 - DA116

## DA117 CHECK TEMPERATURE SENSOR SIGNAL AND SIG RTN CIRCUIT FOR OPEN IN HARNESS

**Note:** Refer to the PCM connector pins numbers on this pinpoint test cover page.

- Disconnect PCM.
- Measure resistance of EOT circuit between PCM harness connector pin and EOT sensor harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector pin and EOT sensor harness connector.

**Is each resistance less than 5.0 ohms?**

Yes	No
REPLACE PCM (Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuits.

## DA120 INTERMITTENT EOT SENSOR CHECK

- Still monitoring PID, complete the following:
  - Tap on sensor to simulate road shock.
  - Wiggle the sensor connector.

**Is there any large change in the PID reading?**

Yes	No
KEY OFF. DISCONNECT and INSPECT connector. If OK, REPLACE the sensor.	GO to DA121 .

## DA121 CHECK EOT ELECTRONIC ENGINE CONTROL (EC) WIRING HARNESS

- Still monitoring PID, complete the following:
  - Wiggle, shake and bend small sections of wiring harness while working from the sensor to the PCM.

**Is there any large change in the PID reading?**

Yes	No
ISOLATE fault. REPAIR as necessary.	Fault is not present at this time. For Continuous Memory DTCs, COMPLETE OBDII Drive Cycle (REFER to Drive Cycles).

## DA130 DTC P0298: ENGINE OIL OVER TEMPERATURE CONDITION

- Engine oil temperature protection strategy in the PCM has been activated.
  - Check for overheating condition and base engine concerns.

### Is there any overheating or base engine concerns?

Yes	No
ISOLATE fault. REPAIR as necessary. REFER to Engine System — General Information.	GO to DA131 .

## DA131 CHECK FOR EOT SENSOR HARDWARE

- Engine oil temperature protection strategy in the PCM can be activated with or without an EOT sensor.

### Does vehicle have an EOT sensor?

Yes	No
GO to DA111 .	IDENTIFY customer driving habits. Advise customer improper transmission gear selection and high rpm for extended period will initialize engine protection strategy.

DA130 - DA131