

Computers and Control Systems: Pinpoint Tests

Test DC: Mass Air Flow Sensor

PINPOINT TEST DC: MASS AIR FLOW SENSOR

Mass Air Flow Sensor

DC

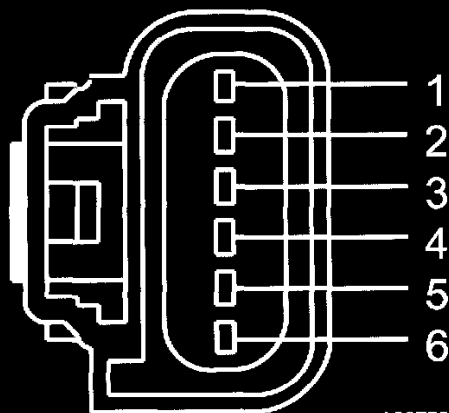
Note

This Pinpoint Test is intended to diagnose the following:

- Mass Air Flow (MAF) Sensor (12B579).
- Harness Circuits: MAF SIG, MAF RTN, Vehicle Power (VPWR), and PowerGround (PWRGND).
- Powertrain Control Module (PCM) (12A650).

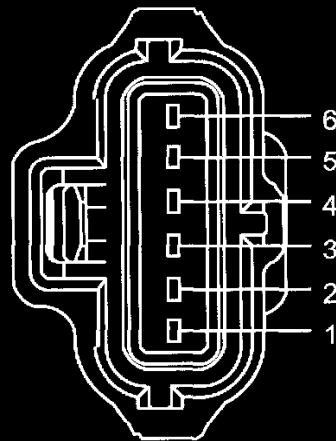
Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor Connector

A



A0077520

B



A0077549

Mass Air Flow Sensor**DC**

Vehicle	Connector	Circuit	Pin
F-150 5.4L, LS, Freestar / Monterey, Ranger	A	MARTN MAF PWRGND VPWR	4 3 5 6
Focus 2.3L	A	MARTN MAF PWRGND VPWR	3 4 2 1
All other vehicles	B	MARTN MAF PWRGND VPWR	4 5 3 2

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Reference Values

Vehicle	Connector	Circuit	Pin
Aviator, LS, Thunderbird	150 (60-32-58) Pin	MARTN MAF	B38 B31
Expedition, Navigator	122 Pin	MARTN MAF	B30 B31
Explorer, Focus 2.3L, Mountaineer	150 (50-50-50) Pin	MARTN MAF	B43 B32
F-150	190 Pin	MARTN MAF	B42 B41
All other vehicles	104 Pin	MARTN MAF	36 88

BAROMETRIC PRESSURE REFERENCE CHART

Barometric Pressure (in. Hg.)	Barometric Pressure (kPa)	BARO/MAP PID (Hz)	Altitude Above Sea Level (ft)
3.5	11.8	89.3	
5	16.9	92.8	
10	33.8	104.6	
15	50.7	117.0	14,000
20	67.5	129.6	10,000
21	70.9	132.5	9,000
22	74.3	135.4	8,000
23	77.7	138.3	7,000
24	81.1	141.1	6,000

(Continued)

Mass Air Flow Sensor

DC

BAROMETRIC PRESSURE REFERENCE CHART

Barometric Pressure (in. Hg.)	Barometric Pressure (kPa)	BARO/MAP PID (Hz)	Altitude Above Sea Level (ft)
25	84.4	144.0	5,000
26	87.8	146.9	4,000
27	91.2	149.8	3,000
28	94.6	152.8	2,000
29	97.9	155.8	1,000
30	101.3	158.9	0 (sea level)
31	104.7	162.0	
31.875	107.7	164.7	

Test Steps		Results	Action to Take
DC1	DTC P1101: CHECK FOR MAF SENSOR CONTINUOUS MEMORY DTCS		
	<ul style="list-style-type: none"> Retrieve CMDTCs. Is a Continuous Memory MAF DTC present with the KOER DTC P1101? 	Yes → No →	GO to DC2 . KEY OFF. GO to DC4 .
DC2	VERIFY CONTINUOUS MEMORY DTC P0102		
	<ul style="list-style-type: none"> Is Continuous Memory DTC P0102 present with the KOER DTC P1101? 	Yes → No →	GO to DC4 . GO to DC3 .
DC3	VERIFY CONTINUOUS MEMORY DTC P0103		
	<ul style="list-style-type: none"> Is Continuous Memory DTC P0103 present with the KOER DTC P1101? 	Yes → No →	GO to DC19 . All other Continuous Memory DTCs: Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Diagnostic Trouble Code (DTC) Charts.
DC4	KOER AND CONTINUOUS MEMORY DTCS P0102, P0104 OR P1101: CHECK INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS AND DAMAGE		
	<ul style="list-style-type: none"> CHECK air inlet system (air cleaner, housing, ductwork, etc.) for obstructions or blockage. CHECK for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in air outlet tube, worn gaskets between MAF sensor and air cleaner assembly. Verify MAF sensor is connected. Repair as necessary. Were there any concerns found during the visual inspection? 	Yes → No →	KEY OFF. Repair as necessary. GO to DC5 .

Chart, Test DC1-DC4

Mass Air Flow Sensor

DC

Test Steps		Results	Action to Take				
DC5	CHECK MAF PID						
	<ul style="list-style-type: none"> Run engine up to 1500 rpm for 5 seconds, then bring it back to idle. Access the MAF V PID using a scan tool. Is the Voltage below 0.23 V? 	Yes → No →	KEY OFF. GO to DC8 . KEY OFF. GO to DC6 .				
DC6	CHECK MAF SIGNAL SENT TO PCM						
	Note: DTC P1101 can be generated by a low charged vehicle battery or the garage exhaust ventilation system. Repair battery as necessary. Then remove ventilation system and properly vent to outside atmosphere. Check air inlet system (air cleaner, housing, ductwork, etc.) for obstructions or blockage. Rerun KOEO Self Test. <ul style="list-style-type: none"> MAF/IAT Sensor connector connected. Key ON Engine OFF. Access the MAF V PID using a scan tool. Is the Voltage below 0.2 V? 	Yes → No →	GO to DC7 . KEY OFF. GO to DC8 .				
DC7	CHECK MAF SIGNAL SENT TO PCM						
	<ul style="list-style-type: none"> Key ON Engine RUN. Access the MAF V PID using a scan tool. Is the Voltage between 0.46 V - 2.44 V? 	Yes → No →	Unable to identify fault at this time. GO to Z1 . KEY OFF. GO to DC8 .				
DC8	CHECK VPWR TO MAF SENSOR						
	<ul style="list-style-type: none"> MAF/IAT Sensor connector disconnected. Key ON Engine OFF. Measure the Voltage between: <table border="1"> <tr> <td>(+)MAF/IAT Sensor Connector, Harness Side</td> <td>(-)Vehicle battery</td> </tr> <tr> <td>VPWR</td> <td>Negative post</td> </tr> </table> <ul style="list-style-type: none"> Is the Voltage above 10.5 V? 	(+)MAF/IAT Sensor Connector, Harness Side	(-)Vehicle battery	VPWR	Negative post	Yes → No →	GO to DC9 . KEY OFF. REPAIR open circuit.
(+)MAF/IAT Sensor Connector, Harness Side	(-)Vehicle battery						
VPWR	Negative post						
DC9	CHECK PWRGND CIRCUIT TO MAF SENSOR						
	<ul style="list-style-type: none"> Measure the Voltage between: <table border="1"> <tr> <td>(+)Vehicle battery</td> <td>(-)MAF/IAT Sensor Connector, Harness Side</td> </tr> <tr> <td>Positive post</td> <td>PWRGND</td> </tr> </table> <ul style="list-style-type: none"> Is the Voltage above 10.5 V? 	(+)Vehicle battery	(-)MAF/IAT Sensor Connector, Harness Side	Positive post	PWRGND	Yes → No →	KEY OFF. GO to DC10 . KEY OFF. REPAIR open circuit.
(+)Vehicle battery	(-)MAF/IAT Sensor Connector, Harness Side						
Positive post	PWRGND						

Test DC5-DC9

Mass Air Flow Sensor

DC

Test Steps		Results	Action to Take						
DC10	CHECK MAF CIRCUIT SHORT TO PWRGND OR MAF RTN IN THE HARNESS								
	<ul style="list-style-type: none"> MAF/IAT Sensor connector disconnected. PCM connector disconnected. Measure the Resistance between: <table border="1"> <tr> <td>(+)MAF/IAT Sensor Connector, Harness Side</td> <td>(-)MAF/IAT Sensor Connector, Harness Side</td> </tr> <tr> <td>MAF</td> <td>PWRGND</td> </tr> <tr> <td>MAF</td> <td>MARTN</td> </tr> </table> <ul style="list-style-type: none"> Are the resistances above 10 KOhm? 	(+)MAF/IAT Sensor Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side	MAF	PWRGND	MAF	MARTN	Yes → No →	GO to DC11 . REPAIR short circuit.
(+)MAF/IAT Sensor Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side								
MAF	PWRGND								
MAF	MARTN								
DC11	CHECK MAF RTN CIRCUIT FOR SHORT TO PWRGND IN HARNESS								
	<ul style="list-style-type: none"> Measure the Resistance between: <table border="1"> <tr> <td>(+)MAF/IAT Sensor Connector, Harness Side</td> <td>(-)MAF/IAT Sensor Connector, Harness Side</td> </tr> <tr> <td>MARTN</td> <td>PWRGND</td> </tr> </table> <ul style="list-style-type: none"> Is the Resistance above 10 KOhm? 	(+)MAF/IAT Sensor Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side	MARTN	PWRGND	Yes → No →	GO to DC12 . REPAIR short circuit to GND.		
(+)MAF/IAT Sensor Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side								
MARTN	PWRGND								
DC12	CHECK MAF CIRCUIT SHORT TO PWRGND IN THE PCM								
	<ul style="list-style-type: none"> PCM connector connected. Measure the Resistance between: <table border="1"> <tr> <td>(+)MAF/IAT Sensor Connector, Harness Side</td> <td>(-)MAF/IAT Sensor Connector, Harness Side</td> </tr> <tr> <td>MAF</td> <td>PWRGND</td> </tr> </table> <ul style="list-style-type: none"> Is the Resistance above 10 KOhm? 	(+)MAF/IAT Sensor Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side	MAF	PWRGND	Yes → No →	GO to DC13 . INSTALL a new PCM.		
(+)MAF/IAT Sensor Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side								
MAF	PWRGND								

Test DC10-DC12

Mass Air Flow Sensor

DC

Test Steps		Results	Action to Take						
DC13	<p>CHECK MAF CIRCUIT VOLTAGE CYCLING INTEGRITY</p> <ul style="list-style-type: none"> • Scan tool connector connected. • Key ON Engine OFF. • Access MAF V PID. • Record the MAF V PID reading. • Add jumper wire between the points described below: <table border="1"> <tr> <td>Point A MAF/IAT Sensor Connector, Harness Side</td> <td>Point B MAF/IAT Sensor Connector, Harness Side</td> </tr> <tr> <td>MARTN</td> <td>PWRGND</td> </tr> <tr> <td>MAF</td> <td>VPWR</td> </tr> </table> <ul style="list-style-type: none"> • Does the MAF V PID change from less than .23 volts (closer to zero volts) to greater than 4.50 volts? 	Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side	MARTN	PWRGND	MAF	VPWR	<p>Yes →</p> <p>No →</p>	<p>KEY OFF. INSTALL a new MAF sensor. REMOVE jumper wire(s) RESET Keep Alive Random Access Memory (RAM) (REFER to Diagnostic Methods, Powertrain Control Module (PCM) Reset).</p> <p>KEY OFF. REMOVE jumper wire(s) GO to DC14.</p>
Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side								
MARTN	PWRGND								
MAF	VPWR								
DC14	<p>CHECK MAF CIRCUIT FOR OPEN IN HARNESS</p> <ul style="list-style-type: none"> • PCM connector disconnected. • Measure the Resistance between: <table border="1"> <tr> <td>(+)PCM Connector, Harness Side</td> <td>(-)MAF/IAT Sensor Connector, Harness Side</td> </tr> <tr> <td>MAF</td> <td>MAF</td> </tr> </table> <ul style="list-style-type: none"> • Is the Resistance below 5 Ohm? 	(+)PCM Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side	MAF	MAF	<p>Yes →</p> <p>No →</p>	<p>GO to DC15.</p> <p>REPAIR open circuit.</p>		
(+)PCM Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side								
MAF	MAF								
DC15	<p>CHECK PWRGND CIRCUIT FOR OPEN IN HARNESS</p> <ul style="list-style-type: none"> • PCM connector disconnected. • Measure the Resistance between: <table border="1"> <tr> <td>(+)MAF/IAT Sensor Connector, Harness Side</td> <td>(-)Vehicle battery</td> </tr> <tr> <td>PWRGND</td> <td>Negative post</td> </tr> </table> <ul style="list-style-type: none"> • Is the Resistance below 5 Ohm? 	(+)MAF/IAT Sensor Connector, Harness Side	(-)Vehicle battery	PWRGND	Negative post	<p>Yes →</p> <p>No →</p>	<p>GO to DC16.</p> <p>REPAIR open circuit.</p>		
(+)MAF/IAT Sensor Connector, Harness Side	(-)Vehicle battery								
PWRGND	Negative post								
DC16	<p>CHECK MAF RTN CIRCUIT FOR OPEN IN HARNESS</p> <ul style="list-style-type: none"> • Measure the Resistance between: <table border="1"> <tr> <td>(+)PCM Connector, Harness Side</td> <td>(-)MAF/IAT Sensor Connector, Harness Side</td> </tr> <tr> <td>MARTN</td> <td>MARTN</td> </tr> </table> <ul style="list-style-type: none"> • Is the Resistance below 5 Ohm? 	(+)PCM Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side	MARTN	MARTN	<p>Yes →</p> <p>No →</p>	<p>INSTALL a new PCM.</p> <p>REPAIR open circuit.</p>		
(+)PCM Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side								
MARTN	MARTN								

Test DC13-DC16

Mass Air Flow Sensor

DC

Test Steps		Results	Action to Take
DC17	DTC P1100: CHECK MAF CIRCUIT FOR INTERMITTENT VOLTAGE TO PCM		
	<ul style="list-style-type: none"> CHECK for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in air outlet tube, worn gaskets between MAF sensor and air cleaner assembly. Verify MAF sensor is connected. Key ON Engine RUN. Access the PCM-MAF V PID using a scan tool. If idle is not stable, GO to Symptom Charts. 	Yes	→ KEY OFF. INSPECT MAF sensor connector. If OK, REPLACE MAF sensor. RESET Keep Alive Random Access Memory (RAM) (REFER to Diagnostic Methods, Powertrain Control Module (PCM) Reset).
	<ul style="list-style-type: none"> Run engine up to 1500 rpm for 5 seconds, then bring it back to idle. Access the MAF V PID using a scan tool. Lightly tap on the MAF sensor and wiggle the harness connector to simulate road shock. Does the MAF PID go below 0.23V or above 4.6V? 	No	→ GO to DC18 .
DC18	CHECK MAF CIRCUIT FOR INTERMITTENT OPEN OR SHORTS		
	<ul style="list-style-type: none"> Key ON Engine RUN. Access the MAF V PID using a scan tool. Wiggle, shake and bend small sections of the wiring harness while working from the sensor to the PCM. Does the MAF PID go below 0.23V or above 4.6V? 	Yes	→ KEY OFF. REPAIR as necessary. RESET Keep Alive Random Access Memory (RAM) (REFER to Diagnostic Methods, Powertrain Control Module (PCM) Reset).
		No	→ KEY OFF. Unable to duplicate or identify fault at this time.
DC19	DTC P0103: CHECK MAF SENSOR SCREEN FOR CONTAMINATION		
	Note: DTC P0103 can be generated by foreign material blocking the MAF sensor screen causing an air flow restriction.	Yes	→ Repair as necessary. Rerun Self Test
	<ul style="list-style-type: none"> CHECK the MAF sensor screen for contamination or blockage. CHECK air cleaner element and air tubes for proper installation and sealing. Were any problems found? 	No	→ GO to DC20 .
DC20	DTC P0103: CHECK MAF SENSOR SIGNAL HIGH INPUT TO PCM		
	<ul style="list-style-type: none"> Key ON Engine OFF. Access the PCM-MAF V PID using a scan tool. Is the Voltage above 2.44 V? 	Yes	→ KEY OFF. GO to DC21 .
		No	→ GO to DC23 .

Test DC17-DC20

Mass Air Flow Sensor

DC

Test Steps		Results	Action to Take				
DC21	<p>CHECK MAF SENSOR SIGNAL SENT TO PCM</p> <ul style="list-style-type: none"> MAF/IAT Sensor connector disconnected. Add jumper wire between the points described below: <table border="1"> <tr> <td>Point A MAF/IAT Sensor Connector, Harness Side</td> <td>Point B MAF/IAT Sensor Connector, Harness Side</td> </tr> <tr> <td>MARTN</td> <td>PWRGND</td> </tr> </table> <ul style="list-style-type: none"> Key ON Engine OFF. Access the PCM-MAF V PID using a scan tool. Is the Voltage below 0.1 V? 	Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side	MARTN	PWRGND	<p>Yes</p> <p>No</p>	<p>→ KEY OFF. REMOVE jumper wire(s) CHECK MAF sensor electrical connector for damage, corrosion, and water ingress. If ok, replace MAF sensor. Reset KAM</p> <p>→ KEY OFF. GO to DC22.</p>
Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side						
MARTN	PWRGND						
DC22	<p>CHECK THE MAF CIRCUIT FOR SHORT TO POWER</p> <ul style="list-style-type: none"> PCM connector disconnected. Key ON Engine OFF. Measure the Voltage between: <table border="1"> <tr> <td>(+)PCM Connector, Harness Side</td> <td>(-)</td> </tr> <tr> <td>MAF</td> <td>Ground</td> </tr> </table> <ul style="list-style-type: none"> Is the Voltage below 1 V? 	(+)PCM Connector, Harness Side	(-)	MAF	Ground	<p>Yes</p> <p>No</p>	<p>→ GO to DC24.</p> <p>→ KEY OFF. REPAIR short circuit to PWR.</p>
(+)PCM Connector, Harness Side	(-)						
MAF	Ground						
DC23	<p>CHECK MAF SENSOR SIGNAL SENT TO PCM</p> <ul style="list-style-type: none"> Key ON Engine RUN. Monitor the MAF signal voltage while increasing the engine RPM from idle to approximately 2500 RPM, and then back to idle. Access the PCM-MAF V PID using a scan tool. Is the Voltage between 0.23 V - 4.6 V? 	<p>Yes</p> <p>No</p>	<p>→ KEY OFF. Intermittent concern. GO to Z1.</p> <p>→ KEY OFF. GO to DC21.</p>				
DC24	<p>VERIFY IDLE CONCERN</p> <ul style="list-style-type: none"> Is there an idle concern present? 	<p>Yes</p> <p>No</p>	<p>→ Disregard DTC P0103 at this time RETURN to Symptom Charts.</p> <p>→ INSTALL a new PCM.</p>				

Mass Air Flow Sensor**DC**

	Test Steps	Results →	Action to Take
DC25	DTC P0171, P0172, P0174, P0175, P1131, P1132, P1151, P1152, P1130, P1150, P2195, P2196, P2197, P2198: (OR LEAN DRIVEABILITY CONCERNS) CHECK CONDITIONS RELATED TO MAF SENSOR		
	<ul style="list-style-type: none"> • CHECK air inlet system (air cleaner, housing, ductwork, etc.) for obstructions or blockage. • CHECK for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in air outlet tube, worn gaskets between MAF sensor and air cleaner assembly. Verify MAF sensor is connected. • Were any problems found? 	Yes → No →	→ Repair as required and reset KAM. → GO to DC26 .

Test DC25

Mass Air Flow Sensor

DC

	Test Steps	Results	Action to Take
DC26	DTC P0171, P0172, P0174, P0175, P1131, P1132, P1151, P1152, P1130, P1150, P2195, P2196, P2197, P2198: (OR LEAN DRIVEABILITY CONCERNS) CHECK CONDITIONS RELATED TO MAF SENSOR		
	<p>Note: Most weather service reports are a local barometric pressure that has been corrected to sea level. However, the BARO PID reports the actual barometric pressure for the altitude the vehicle is being diagnosed in. Local weather conditions (high or low pressure areas) will change the local barometric pressure by several inches of mercury.</p> <ul style="list-style-type: none"> • Key ON Engine RUN. • Access the PCM-LONGFT1, PCM-LONGFT2, PCM-MAF V and PCM-BARO PIDs using a scan tool. • CHECK that the BARO PID is approximately the same as the barometric pressure reading for the location, day and altitude the vehicle is being diagnosed at. <ul style="list-style-type: none"> — BARO PID values in Keep Alive Memory require updating at high throttle openings. If vehicle is driven down from higher altitudes for diagnosing, complete three or four heavy accelerations at greater than half-throttle to allow BARO PID to update. — BARO PID must be within +/- 6 Hz. (+/- 2 in Hg.) of the altitude value in Barometric Pressure Reference Chart (at the beginning of this pinpoint test). — Make BARO PID comparisons to Barometric Pressure Reference Chart or daily airport barometric pressure reports, if available. • CHECK that the LONGFT1 and LONGFT2 PIDs for all injector banks at idle are not more negative than -12%. • CHECK that the MAF V PID at idle and neutral is not greater than 30% of the normal MAF V listed in Reference Values (or not greater than 1.1 volts). • Are two of the three checks OK? 	Yes No	→ GO to DC28 . → KEY OFF. GO to DC27 .

Test DC26

Mass Air Flow Sensor

DC

Test Steps		Results →	Action to Take
DC27	CHECK TO ISOLATE MAF SENSOR FROM LEAN DRIVEABILITY OCCURRENCE		
	<ul style="list-style-type: none"> Due to increasingly stringent emission/OBD2 requirements, a fuel system DTC on some vehicles will be generated without a noticeable driveability concern with or without the MAF sensor disconnected. Under these conditions, if the BARO_V, LONGFT1, LONGFT2 and MAF PIDs indicate a MAF sensor concern, install a new MAF sensor. MAF/IAT Sensor connector disconnected. Key ON Engine RUN. Drive the vehicle on the road. Is the lean driveability symptom (lack of power, spark knock/detonation, buck/jerk or hesitation/surge on acceleration) gone? 	Yes → No →	→ INSTALL a new MAF/IAT sensor. Reset KAM → GO to DC28 .
DC28	VERIFY DTC		
	<ul style="list-style-type: none"> Are any of the following DTCs present: P0171, P0172, P0174, P0175, P1130, P1131, P1132, P1150, P1151, P1152, P2195, P2196, P2197 or P2198. 	Yes → No →	→ GO to DC29 . → Concern is elsewhere. RETURN to Symptom Charts for further direction.
DC29	VERIFY TYPE OF VEHICLE		
	<ul style="list-style-type: none"> Is this a natural gas vehicle? 	Yes → No →	→ For P1131, P1151, P2195 and P2197 GO to HA36 . → For P1132, P1152, P2196 and P2198 GO to HA41 . → GO to H18 .

Test DC27-DC29