Computers and Control Systems: Pinpoint Tests
Test DC: Mass Air Flow (MAF) Sensor
PINPOINT TEST DC: MASS AIR FLOW (MAF) SENSOR

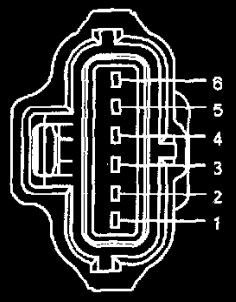
Mass Air Flow (MAF) Sensor	DC

This pinpoint test is intended to diagnose the following:

- Mass Air Flow Sensor (12B579).
- Harness circuits: MAF SIG, MAF RTN, Vehicle Power (VPWR), Power Ground (PWRGND), IAT and SIGRTN.
- Powertrain control module (PCM) (12A650).

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

A



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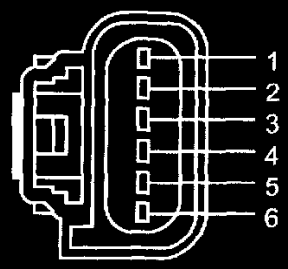
B



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Vehicle	Connector	Circuit	Pin
Aviator, Escape 3.0L, Explorer SportTrac, F-150 4.6L	A	IAT SIGRTN MAF RTN MAF PWRGND VPWR	1 6 3 2 4 5
F-150 4.2L	A	MAF RTN MAF PWRGND VPWR	3 2 4 5
All other vehicles	B	IAT SIGRTN MAF RTN MAF PWRGND VPWR	1 2 4 3 5 6

Note, Connectors

Mass Air Flow (MAF) Sensor — DC

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	MAF MAF RTN	B31 B38
E-Series, F-Super Duty, Mustang	170 Pin	MAF MAF RTN	E25 E26
Excursion, Explorer SportTrac, Freestar/Monterey, Ford GT, Ranger, Sable, Taurus	104 Pin	MAF MAF RTN	88 36
Expedition, F-150, Navigator	190 Pin	MAF MAF RTN	B41 B42
All other vehicles	150 (50-50-50) Pin	MAF MAF RTN	B32 B43

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
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	

Mass Air Flow (MAF) Sensor — DC

Test Step		Results / Action to Take
DC1	**DTC P1101: CHECK FOR MAF SENSOR CONTINUOUS MEMORY DTCS**	
	• Retrieve CMDTCs. • **Is a continuous memory MAF DTC present with the KOER DTC P1101?**	**Yes** GO to **DC2.** **No** Key in OFF position. GO to **DC4.**
DC2	**VERIFY CONTINUOUS MEMORY DTC P0102**	
	• **Is a continuous memory DTC P0102 present with the KOER DTC P1101?**	**Yes** GO to **DC4.** **No** GO to **DC3.**
DC3	**VERIFY CONTINUOUS MEMORY DTC P0103**	
	• **Is a continuous memory DTC P0103 present with the KOER DTC P1101?**	**Yes** GO to **DC20.** **No** All other continuous memory DTCs: DISREGARD the current diagnostic trouble code (DTC) at this time. ADDRESS the next DTC. GO to Diagnostic Trouble Code (DTC) Charts and Descriptions.
DC4	**KOER AND CONTINUOUS MEMORY DTCS P0102, P0104 OR P1101: CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS, AND DAMAGE**	
	• Check the air inlet system (air cleaner, housing, ductwork) for obstructions or blockage. • Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Verify the MAF sensor is connected. Repair as necessary. • **Are there any concerns found during the visual inspection?**	**Yes** Key in OFF position. REPAIR as necessary. **No** GO to **DC5.**
DC5	**CHECK THE MAF PID**	
	• Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle. • Access the PCM and monitor the MAF V PID. • **Is the voltage less than 0.23 V?**	**Yes** Key in OFF position. GO to **DC8.** **No** Key in OFF position. GO to **DC6.**

Mass Air Flow (MAF) Sensor — DC

Test Step	Results / Action to Take
DC6 CHECK THE MAF SIGNAL SENT TO THE PCM	
Note: DTC P1101 can be generated by a low charged vehicle battery or the garage exhaust ventilation system. Charge the battery as necessary, then remove the ventilation system and properly vent to the outside atmosphere. Check the air inlet system (air cleaner, housing, ductwork) for obstructions or blockage. Rerun the KOEO self-test. • MAF/IAT Sensor connector connected. • Key in ON position. • Access the PCM and monitor the MAF V PID. • **Is the voltage less than 0.2 V?**	**Yes** GO to **DC7**. **No** Key in OFF position. GO to **DC8**.
DC7 CHECK THE MAF SIGNAL SENT TO THE PCM	
• Key on engine running. • Access the PCM and monitor the MAF V PID. • **Is the voltage between 0.46 V - 2.44 V?**	**Yes** Unable to identify the fault at this time. GO to **Z1**. **No** Key in OFF position. GO to **DC8**.
DC8 CHECK THE VPWR TO THE MAF SENSOR	
• MAF/IAT Sensor connector disconnected. • Key in ON position. • Measure the voltage between: (+) MAF/IAT Sensor Connector, Harness Side: VPWR (-) Vehicle Battery: Negative terminal • **Is the voltage greater than 10.5 V?**	**Yes** GO to **DC9**. **No** Key in OFF position. REPAIR the open circuit.
DC9 CHECK THE PWRGND CIRCUIT TO MAF SENSOR	
• Measure the voltage between: (+) Vehicle Battery: Positive terminal (-) MAF/IAT Sensor Connector, Harness Side: PWRGND • **Is the voltage greater than 10.5 V?**	**Yes** Key in OFF position. GO to **DC10**. **No** Key in OFF position. REPAIR the open circuit.

Mass Air Flow (MAF) Sensor — DC

Test Step	Results / Action to Take
DC10 CHECK FOR SHORTS BETWEEN CIRCUITS IN MAF HARNESS **Note:** For vehicles with a stand alone MAF sensor (IAT sensor not internal to the MAF sensor), disregard MAF circuit checks to IAT and SIGRTN. • MAF/IAT Sensor connector disconnected. • PCM connector disconnected. • Measure the resistance between: (+) MAF/IAT Sensor Connector, Harness Side: MAF (-) MAF/IAT Sensor Connector, Harness Side: PWRGND (+) MAF/IAT Sensor Connector, Harness Side: MAF (-) MAF/IAT Sensor Connector, Harness Side: MAF RTN (+) MAF/IAT Sensor Connector, Harness Side: MAF (-) MAF/IAT Sensor Connector, Harness Side: SIGRTN (+) MAF/IAT Sensor Connector, Harness Side: MAF (-) MAF/IAT Sensor Connector, Harness Side: IAT • **Are the resistances greater than 10K ohms?**	**Yes** GO to **DC11**. **No** REPAIR the short circuit.
DC11 CHECK THE MAF RTN CIRCUIT FOR AN OPEN IN THE HARNESS • Measure the resistance between: (+) PCM Connector, Harness Side: MAF RTN (-) MAF/IAT Sensor Connector, Harness Side: MAF RTN • **Is the resistance less than 5 ohms?**	**Yes** GO to **DC12**. **No** REPAIR the open circuit.
DC12 CHECK THE MAF RTN CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS • Measure the resistance between: (+) MAF/IAT Sensor Connector, Harness Side: MAF RTN (-) MAF/IAT Sensor Connector, Harness Side: PWRGND • **Is the resistance greater than 10K ohms?**	**Yes** GO to **DC13**. **No** REPAIR the short circuit to GND.
DC13 CHECK THE MAF CIRCUIT FOR A SHORT TO PWRGND IN THE PCM • PCM connector connected. • Measure the resistance between: (+) MAF/IAT Sensor Connector, Harness Side: MAF (-) MAF/IAT Sensor Connector, Harness Side: PWRGND • **Is the resistance greater than 10K ohms?**	**Yes** GO to **DC14**. **No** INSTALL a new PCM. REFER to Diagnostic Methods, Flash Electrically Erasable Programmable Read Only Memory (EEPROM).

Mass Air Flow (MAF) Sensor — DC

Test Step	Results / Action to Take
DC14 CHECK THE MAF CIRCUIT VOLTAGE CYCLING INTEGRITY • Diagnostic tool connector connected. • Key in ON position. • Access the MAF V PID. • Connect a 5 amp fused jumper wire between the following: **Point A MAF/IAT Sensor Connector, Harness Side:** MAF RTN; MAF **Point B MAF/IAT Sensor Connector, Harness Side:** PWRGND; VPWR • Take the PID reading while both jumpers are installed. • Remove the VPWR jumper while observing the MAF V PID. • **Does the MAF V PID change from greater than 4.50 volts to less than 0.26 volt when the VPWR jumper is removed?**	**Yes** Key in OFF position. REMOVE the jumper wire(s). If OK, INSTALL a new MAF sensor. RESET the keep alive memory (KAM). REFER to Diagnostic Methods, Resetting The Keep Alive Memory (KAM). **No** Key in OFF position. REMOVE the jumper wire(s). GO to **DC15.**
DC15 CHECK THE MAF CIRCUIT FOR AN OPEN IN THE HARNESS • PCM connector disconnected. • Measure the resistance between: **(+) PCM Connector, Harness Side:** MAF **(-) MAF/IAT Sensor Connector, Harness Side:** MAF • **Is the resistance less than 5 ohms?**	**Yes** GO to **DC16.** **No** REPAIR the open circuit.
DC16 CHECK THE PWRGND CIRCUIT FOR AN OPEN IN THE HARNESS • PCM connector disconnected. • Measure the resistance between: **(+) MAF/IAT Sensor Connector, Harness Side:** PWRGND **(-) Vehicle Battery:** Negative terminal • **Is the resistance less than 5 ohms?**	**Yes** GO to **DC17.** **No** REPAIR the open circuit.

Mass Air Flow (MAF) Sensor — DC

Test Step		Results / Action to Take
DC17	**CHECK THE MAF RTN CIRCUIT FOR AN OPEN IN THE HARNESS**	
	• Measure the resistance between: (+) PCM Connector, Harness Side: MAF RTN (-) MAF/IAT Sensor Connector, Harness Side: MAF RTN • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new PCM. REFER to Diagnostic Methods, Flash Electrically Erasable Programmable Read Only Memory (EEPROM). **No** REPAIR the open circuit.
DC18	**DTC P1100: CHECK THE MAF CIRCUIT FOR INTERMITTENT VOLTAGE TO THE PCM**	
	• Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Verify the MAF sensor is connected. • Key on engine running. • Access the PCM and monitor the MAF V PID. • If idle is not stable, refer to Symptom Charts. • Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle. Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle. • Access the PCM and monitor the MAF V PID. • Lightly tap on the MAF sensor and wiggle the harness connector to simulate road shock. • **Does the MAF PID go below 0.23 volt or above 4.6 volts?**	**Yes** Key in OFF position. INSPECT the MAF sensor connector. If OK, INSTALL a new MAF sensor. RESET the keep alive memory (KAM). REFER to Diagnostic Methods, Resetting The Keep Alive Memory (KAM). **No** GO to **DC19**.
DC19	**CHECK THE MAF CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS**	
	• Key on engine running. • Access the PCM and monitor the MAF V PID. • Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM. • **Does the MAF PID go below 0.23 volt or above 4.6 volts?**	**Yes** Key in OFF position. REPAIR as necessary. RESET the keep alive memory (KAM). REFER to Diagnostic Methods, Resetting The Keep Alive Memory (KAM). **No** Key in OFF position. Unable to duplicate or identify the fault at this time.

Mass Air Flow (MAF) Sensor — DC

Test Step		Results / Action to Take
DC20	**DTC P0103: CHECK THE MAF SENSOR SCREEN FOR CONTAMINATION**	
	Note: DTC P0103 can be generated by foreign material blocking the MAF sensor screen, causing an air flow restriction. • Check the MAF sensor screen for contamination or blockage. • Check the air cleaner element and air tubes for proper installation and sealing. • **Were any problems found?**	**Yes** REPAIR as necessary. RERUN Self-Test. **No** GO to **DC21**.
DC21	**DTC P0103: CHECK THE MAF SENSOR SIGNAL HIGH INPUT TO THE PCM**	
	• Key in ON position. • Access the PCM and monitor the MAF V PID. • **Is the voltage greater than 2.44 V?**	**Yes** Key in OFF position. GO to **DC22**. **No** GO to **DC24**.
DC22	**CHECK THE MAF SENSOR SIGNAL SENT TO THE PCM**	
	• MAF/IAT Sensor connector disconnected. • Connect a 5 amp fused jumper wire between the following: **Point A MAF/IAT Sensor Connector, Harness Side**: MAF RTN **Point B MAF/IAT Sensor Connector, Harness Side**: PWRGND • Key in ON position. • Access the PCM and monitor the MAF V PID. • **Is the voltage less than 0.1 V?**	**Yes** Key in OFF position. REMOVE the jumper wire(s). CHECK the MAF sensor electrical connector for damage, corrosion, and water ingress. If OK, INSTALL a new MAF sensor. RESET the keep alive memory (KAM). REFER to Diagnostic Methods, Resetting The Keep Alive Memory (KAM). **No** Key in OFF position. GO to **DC23**.
DC23	**CHECK THE MAF CIRCUIT FOR A SHORT TO POWER**	
	• PCM connector disconnected. • Key in ON position. • Measure the voltage between: **(+) PCM Connector, Harness Side**: MAF **(-)**: Ground • **Is the voltage less than 1 V?**	**Yes** GO to **DC25**. **No** Key in OFF position. REPAIR the short circuit to PWR.

Mass Air Flow (MAF) Sensor — DC

Test Step	Results / Action to Take
DC24 CHECK THE MAF SIGNAL SENT TO THE PCM	
• Key on engine running. • Monitor the MAF signal voltage while increasing the engine RPM from idle to approximately 2,500 RPM, and then back to idle. • Access the PCM and monitor the MAF V PID. • **Is the voltage between 0.23 V - 4.6 V?**	**Yes** Key in OFF position. Intermittent concern. GO to **Z1**. **No** Key in OFF position. GO to **DC22**.
DC25 VERIFY THE IDLE CONCERN	
• PCM connector connected. • MAF/IAT Sensor connector connected. • Key on engine running. • **Is there an idle concern present?**	**Yes** DISREGARD DTC P0103 at this time. Concern is elsewhere. RETURN to Symptom Charts for further direction. **No** INSTALL a new PCM. REFER to Diagnostic Methods, Flash Electrically Erasable Programmable Read Only Memory (EEPROM).
DC26 DTC P0171, P0172, P0174, P0175, P1131, P1132, P1151, P1152, P1130, P1150, P2195, P2196, P2197, P2198: (OR LEAN DRIVEABILITY CONCERNS) CHECK THE CONDITIONS RELATED TO THE MAF SENSOR	
• Check the air inlet system (air cleaner, housing, ductwork) for obstructions or blockage. • Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Verify the MAF sensor is connected. • **Are any problems found?**	**Yes** REPAIR as necessary. RESET the keep alive memory (KAM). REFER to Diagnostic Methods, Resetting The Keep Alive Memory (KAM). **No** GO to **DC27**.

Mass Air Flow (MAF) Sensor — DC

Test Step		Results / Action to Take
DC27	**DTC P0171, P0172, P0174, P0175, P1131, P1132, P1151, P1152, P1130, P1150, P2195, P2196, P2197, P2198: (OR LEAN DRIVEABILITY CONCERNS) CHECK CONDITIONS RELATED TO THE MAF SENSOR**	
	Note: Most weather reports include a local barometric pressure that has been corrected to sea level. However, the BARO PID reports the actual barometric pressure for the altitude where the vehicle is being diagnosed. Local weather conditions (high or low pressure areas) will change the local barometric pressure by several inches of mercury. • Key on engine running. • Access the PCM and monitor the LONGFT1, LONGFT2, MAF V and BARO PIDs. • Check that the BARO PID is approximately the same as the barometric pressure reading for the location, day, and altitude where the vehicle is being diagnosed. — The BARO PID values in Keep Alive Memory require updating at high throttle openings. If the vehicle is driven down from higher altitudes for diagnosis, carry out 3 or 4 heavy accelerations at greater than half-throttle to allow the BARO PID to update. — The 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 the 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 2 of the 3 checks OK?**	**Yes** GO to **DC29**. **No** Key in OFF position. GO to **DC28**.
DC28	**CHECK TO ISOLATE MAF SENSOR FROM LEAN DRIVEABILITY OCCURRENCE**	
	• Due to increasingly stringent emission/OBD requirements, a fuel system DTC on some vehicles can 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 running. • 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** If OK, INSTALL a new MAF/IAT sensor. RESET the keep alive memory (KAM). REFER to Diagnostic Methods, Resetting The Keep Alive Memory (KAM). **No** GO to **DC29**.

Mass Air Flow (MAF) Sensor — DC

Test Step		Results / Action to Take
DC29	VERIFY THE DTC	
	• Are any of the following DTCs present: P0171, P0172, P0174, P0175, P1130, P1131, P1132, P1150, P1151, P1152, P2195, P2196, P2197, or P2198?	Yes GO to H22. No Concern is elsewhere. RETURN to Symptom Charts for further direction.