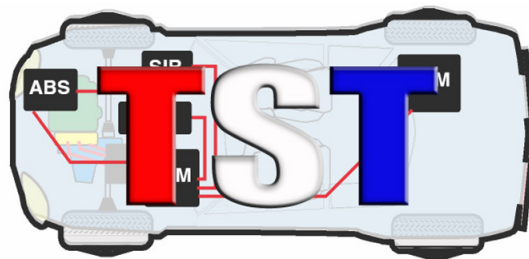


May 2009



Technicians Service Training

INSIDE THIS ISSUE:

Directions for MAP Sensors

P. 1 - 7

MAF Sensors *P. 7 - 10*

Upcoming Seminars:

June 1st - 4th

Wiring Diagram Analysis

Jorge Menchu

Summer Break

July and August 09

Webcasts are ongoing!

September 14 - 17

Airbags

David Decourcey

Editor

Jerry "G" Truglia

© 2009 ATTS INC.

Helpful Directions for MAP Sensors

Some vehicle owners might think a MAP sensor is some kind of gizmo that tracks the whereabouts of their vehicle. There are high-tech on-board navigational systems that can do just that, but the MAP sensor plays no role in such a system.



It's an engine sensor that provides directions of a different sort. The MAP sensor's job is to keep the computerized engine control system informed about engine load so the fuel mixture, spark timing and other emission functions can be adjusted to suit changing operating conditions. It's an essential job that requires accurate calibration and trouble-free operation for good engine performance and driveability. So here are some directions of our own about MAP sensors along with diagnostic procedures you can use to troubleshoot this crucial sensor.

Follow These Directions To Find MAP Problems:

MAP stands for "Manifold Absolute Pressure", which is the pressure inside the engine's intake manifold. Pressure is low when intake vacuum is high (as at idle), and pressure is high when vacuum is low (as at wide-open throttle). It's called an "absolute" pressure reading because it depends solely on pressure inside the manifold, though some types of MAP sensors are actually "differential" pressure sensors that measure the difference between intake vacuum and atmospheric (barometric) pressure.

(Con't on page 3)

*Technicians Service Training***11 Lupi Plaza****Mahopac, NY 10541****Phone:** (845) 628-6928**Fax:** (845) 628-1909**Email:****Info@tstseminars.org**

No part of this newsletter may be reproduced, stored in a retrieval system, or transmitted, in any form by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission of the authors.

Information contained in this newsletter is intended for use by professional auto repair technicians familiar with approved vehicle repair procedures. The authors are not responsible for physical injury or property damage resulting from the incorrect application of information or procedures outlined in this volume.

Currently there are **TST chapters in Connecticut, Massachusetts, New Jersey, New York** and membership continues to grow. For more information you can call

TST headquarters at:

(845) 628-6928



Technicians Service Training



www.TSTseminars.org

What is TST?

TST is a group of dedicated technicians and instructors committed to the continuing education of our fellow technicians. We provide once a month training seminars to technicians at a reasonable price. TST brings our members nationally known instructors and state of the art training.

Our Goal & Mission Statement

- ***Keep our fellow technicians up to date with the latest technology.***
- ***Provide training seminars for a reasonable price.***
- ***Deliver information that the technician can use now.***
- ***Keep technicians informed of information affecting our industry.***
- ***Increase consumer awareness of what a good technician is.***

Why join TST?

TST membership includes special pricing on once a month week-day night seminars and the occasional full Saturday seminar. With a \$75.00 yearly membership, the monthly seminars are only \$65.00. TST classes are NOT sales or product seminars. The instructors that TST brings in are all “hands-on” industry experts with up to date, cutting edge knowledge that you can use in your shop the next day. That’s 65 dollars for a seminar in which you are able to learn something useful, for fixing those tough jobs that we all see on a regular basis. Our instructors are masters at making the complex understandable. Membership also includes a Monthly Newsletter full of real world technical articles, diagnostic case studies, and solutions to the kinds of problems you see in your bays each week.

The following are some of TST’s regular instructors:

Bernie Thompson of ATS www.ATSnrm.com

John Thornton formerly of Team AVI

Wayne Colonna of ATSG www.ATSGmiami.com

Jorge Menchu the “Labscope Guru,” owner of AES

www.aeswave.com/aboutaes.htm

John Anello Auto Tech On Wheels www.autotechonwheels.com

Luis Ruiz Mechanic’s Education Association

www.meatraining.com

Jerry “G” Truglia National Instructor & owner of A.T.T.S. Inc.

www.attstraining.com

Helpful Directions for MAP Sensors (con't from p. 1)

A MAP sensor reads engine vacuum through a hose connected to the intake manifold. A pressure sensitive ceramic or silicon element and electronic circuit inside the sensor generates a voltage signal that changes with intake vacuum. The sensor itself may be located in the engine compartment or under the dashboard. Most MAP sensors have three terminals: a ground terminal, a voltage reference (VRef) supply terminal (typically 5 volts, which is provided by the computer), and an output terminal for sending data back to the computer.

As engine load changes, so does the MAP sensor's output. The sensor's output voltage will vary depending on the application, but a typical GM sensor reading might be 1.25 volts at idle and just under 5 volts at wide-open throttle. Voltage reads low when vacuum is high, and increases as vacuum drops. Output generally changes about 0.7 to 1.0 volts for every 5 inches of change in vacuum. Ford MAP sensors work somewhat differently in that they produce a digital frequency signal rather than an analog D.C. voltage signal. These sensors output a square wave signal that increases in frequency as vacuum drops. A typical reading at idle might be 95 Hertz (Hz or cycles per second) when vacuum is high, and 150 Hz at wide-open throttle when vacuum is low.

The MAP sensor's signal is used by the powertrain control module (PCM) to adjust the air/fuel mixture and spark timing. Under low load, high-vacuum conditions, the PCM typically leans the air/fuel mixture and advances spark timing for better fuel economy. Under high-load low-vacuum conditions, the PCM richens the air/fuel mixture for more power and retards spark timing to prevent detonation (spark knock). These control functions are programmed into the computer and require accurate sensor inputs. So if the MAP sensor is defective or out of calibration, driveability and performance problems can occur.

Engines with a "speed-density" type of electronic fuel injection system (no airflow sensor) are especially dependent on the MAP sensor's signal because the PCM uses it along with engine rpm, throttle-position and ambient air temperature to calculate air flow. Engines that do not have a MAP sensor estimate engine load using input from the airflow and throttle-position sensors.

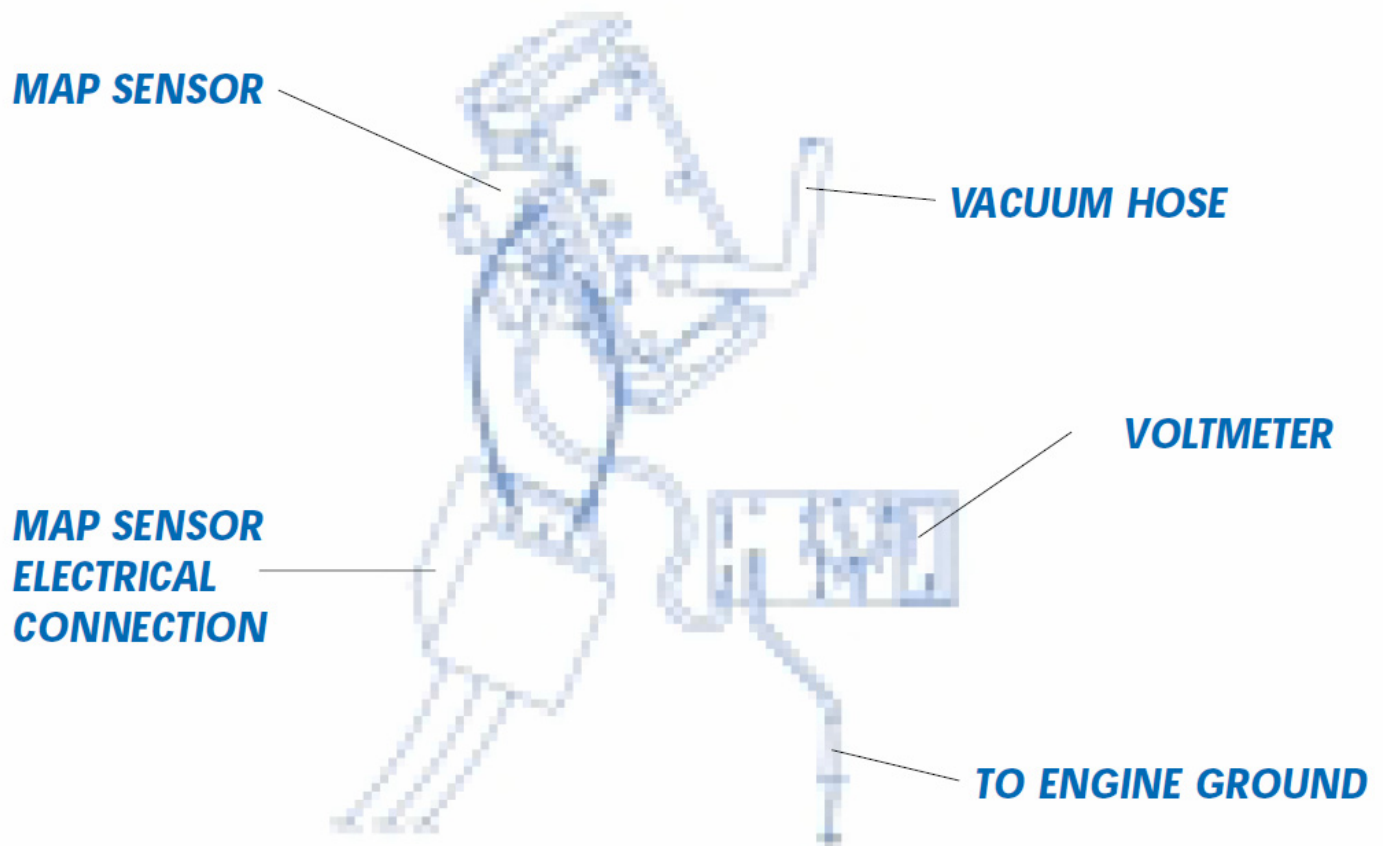
Driveability symptoms that can be caused by a bad MAP sensor, grounds or opens in the sensor's wiring circuit, vacuum leaks in the sensor hose or intake manifold include hard starting, hesitation, engine misfires, stalling, rough or erratic idle, pinging, black exhaust smoke (rich fuel condition resulting in high hydrocarbon emissions), poor fuel economy and generally poor engine performance.

MAP SENSOR CHECKS:

There are numerous ways to check a MAP sensor, including using a scan tool to check for MAP DTCs, observing the sensor's output as a waveform on a scope, and/or comparing the sensor's output voltage or frequency (Ford) to specs in a manual. ***(Con't on page 4)***

Helpful Directions for MAP Sensors (con't from p. 3)

But here are two relatively simple procedures that can quickly tell you whether or not a MAP sensor is responding to changes in intake vacuum. You can test General Motors and Chrysler MAP sensors on the vehicle using a digital voltmeter (DVOM) and two jumper wires:



1. Disconnect the MAP sensor's electrical connector.
2. Connect one jumper wire between the connector and the MAP's terminal "A".
3. Connect another jumper wire from the connector to terminal "C".
4. Connect the positive lead on the DVOM to terminal "B" (the sensor's output terminal) and the negative DVOM test lead to a good engine ground.
5. Turn the ignition key ON and observe the voltage. If the reading falls in the voltage range of 4 to 5 volts (2 to 3 volts for turbocharged engines) at sea level, the sensor is functioning properly at this point..
6. Be sure the vacuum hose between the MAP sensor and engine is in good condition and does not leak. Then start the engine and let it idle.

An idling engine will produce a large amount of intake vacuum, which should pull the MAP sensor's voltage down to a low reading of 1 to 2 volts (note: readings will vary with altitude).

(Con't on page 6)

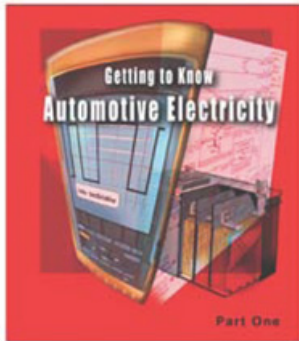
1-800-872-8921

www.Run-Rite.com



**PRODUCTS
PROGRAMS
PEOPLE™**

Products, tools and equipment that technicians love.
Ask about our complete equipment programs.



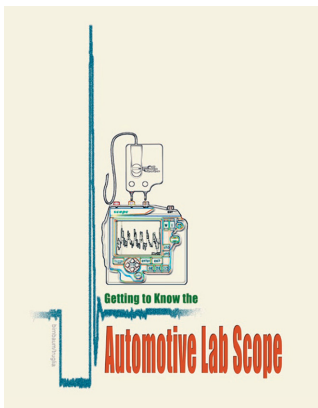
Part One
Batteries
Starters
Alternators
Common Tests and Testers
Circuit Types
Ohm's Law

©2003 Ralph Benzaun / "G" Jerry Truglio



845 628-1062

www.ATTStraining.com



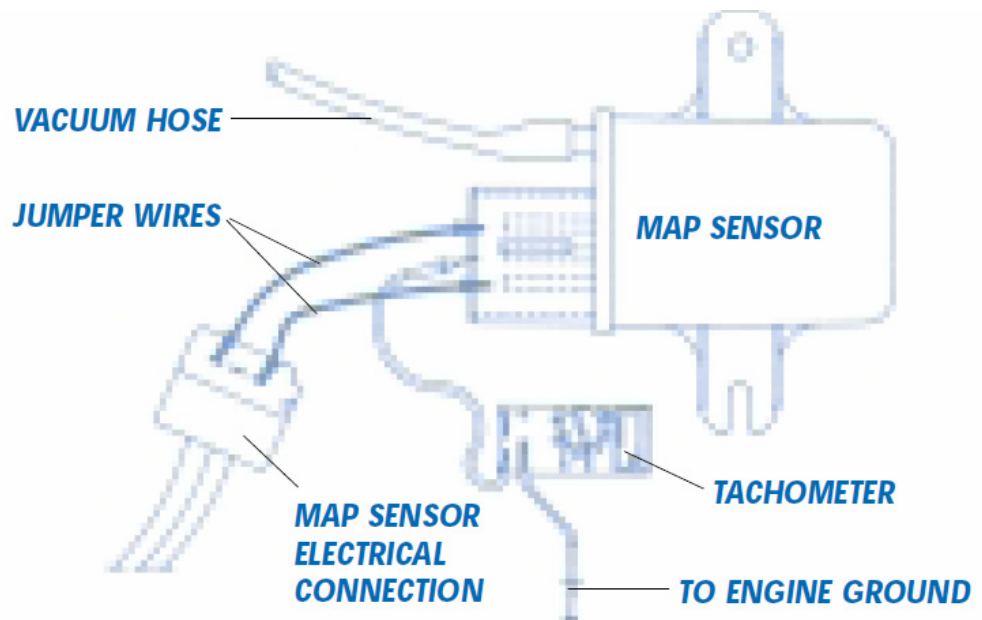
Helpful Directions for MAP Sensors (con't from p. 4)

You can also do this test with the key on, engine off by applying vacuum to the MAP sensor's hose with a hand-held vacuum pump. But do NOT apply more than 20 inches of vacuum (excessive vacuum may damage the sensor).

This test verifies that the MAP sensor is responding to changes in engine vacuum. If the reading does not change, it means the sensor is faulty or the vacuum hose is plugged or leaking.

On Ford applications, a multimeter that can read frequency is normally required to check the sensor's output. But you can also use an ordinary tachometer because a tach can display a frequency signal. Here's the procedure:

1. Set the tachometer to the four-cylinder scale (regardless of how many cylinders the engine has).
2. Connect one tachometer lead to the middle terminal on the MAP sensor and the other tachometer test lead to ground.



3. Connect the two jumper cables the same as before, attaching each end terminal on the sensor to its respective wire in the wiring connector.

(Con't on page 7)

Helpful Directions for MAP Sensors (con't from page 6)

4. If you want to measure engine vacuum so you can correlate it to a specific frequency reading, connect a vacuum gauge to a source of manifold vacuum on the engine, or tee the gauge into the MAP sensor hose.
5. Turn the ignition ON and note the initial reading. The reading on the tachometer should be about 454 to 464 at sea level, which corresponds to a frequency output of 152 to 155 Hz.
6. Start the engine and check the reading again. If the MAP sensor is functioning properly, the reading should drop to about 290 to 330 on the tachometer, which corresponds to a frequency output of about 93 to 98 Hz. No change would indicate a defective sensor or leaky or plugged vacuum hose.

Article courtesy of **WELLS**

Getting the Flow of MAF Sensors

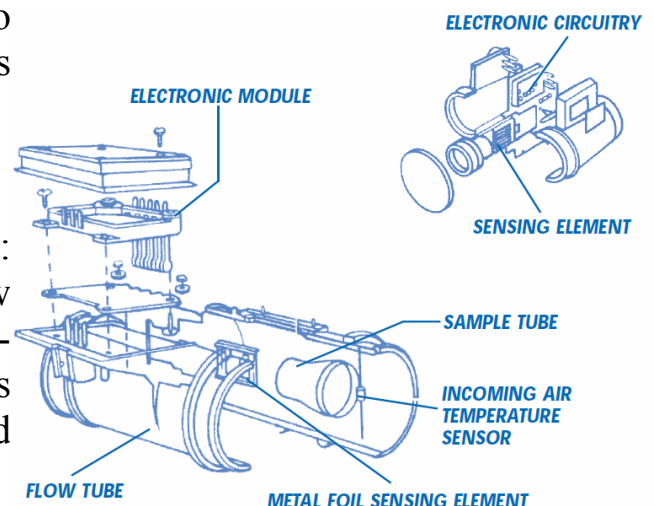
Mass Air Flow (MAF) sensors are used on some General Motors, Ford and import multiport fuel-injected engines to measure the volume of air entering the engine.

This is necessary for the engine's computer to calculate and maintain the proper air/fuel ratio for optimum performance and emissions. Other engines with "speed-density" fuel injection systems do not have a MAF sensor and use inputs from the throttle position sensor (TPS), manifold absolute pressure (MAP) sensor, incoming air temperature (IAT) sensor and engine rpm to estimate air flow.

The MAF sensor is located in the air duct between the air cleaner and throttle body. Here, it can measure all the air that is being drawn into the engine and react almost instantly to changes in throttle position and engine load.

WIRE & FILM

There are two basic varieties of MAF sensors: hot-wire and hot-film. Unlike vane air flow (VAF) sensors that have a mechanical spring-loaded flap to measure air flow, MAF sensors have no moving parts. Instead, they use a heated sensing element to measure air flow.



Questions:

1. Do you want seminars to continue in your area?

2. Do you find the seminars useful?

Please ask a fellow technician to come and check-out our seminars so we can continue to bring you the best available information each month.

We need your support:

Thank you, G Truglia

Getting the Flow of MAF Sensors (con't from page 7)

In a hot-wire MAF, a platinum wire is heated 212 degrees F above the incoming air temperature. In a hot-film MAF, a foil grid is heated 167 degrees F above ambient air temperature. As air flows past the sensing element, it has a cooling effect. This increases the current needed to keep the sensing element at a constant temperature. The cooling effect varies directly with the temperature, density and humidity of the incoming air, so the current change is proportional to the air "mass" entering the engine.



The output signal produced by the MAF sensor varies according to the application. The hot-wire Bosch MAF sensors, which are found on some import cars with LH-Jetronic fuel injection dating back to 1979 as well as 1985-89 GM 5.0L and 5.7L Tuned Port Injection (TPI) engines, generate an analog voltage signal that varies from 0 to 5 volts. Output at idle is usually 0.4 to 0.8 volts increasing up to 4.5 to 5.0 volts at wide-open throttle.

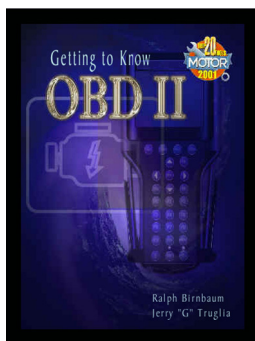
The hot-film MAFs, which AC Rochester introduced in 1984 on the Buick turbo 3.8L V6 and were also used on Chevrolet 2.8L engines and GM 3.0L and 3.8L V6 engines, produce a square-wave variable frequency output. The frequency range varies from 32 to 150 Hz, with 32 Hz being average for idle and 150 Hz for wide-open throttle. In 1990, GM switched most of its engines back to speed-density fuel injection systems, except for the Buick 3.3L and 3.8L which changed to a Hitachi MAF sensor.

Another difference between the hot-wire and hot-film sensors is that the Bosch hot-wire units have a self-cleaning cycle where the platinum wire is heated to 1,000 degrees C (1,832 F) for one second after the engine is shut down. The momentary surge in current is controlled by the onboard computer through a relay to burn off contaminants that might otherwise foul the wire and interfere with the sensor's ability to read incoming air mass accurately.

DIAGNOSIS

An engine with a bad MAF sensor may be hard to start or stall after starting. It may hesitate under load, surge, idle rough or run excessively rich or lean. The engine may also hiccup when the throttle suddenly changes position.

(Con't on page 9)



**ARE YOU
SAVING
\$35.00 EACH
SEMINAR?**

**IF NOT, YOU
NEED TO JOIN**

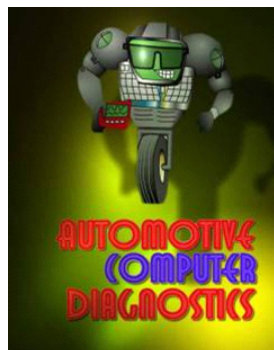


**DO YOU HAVE
AN
INTERESTING
PROBLEM
TO WRITE
ABOUT?**

CONTACT US!

(845) 628-6928

TSTSEMINARS.ORG



Getting the Flow of MAF Sensors (con't from page 8)

If you suspect a MAF sensor problem, scan for any fault codes. A MAF problem should (but does not always) set a fault code. Codes that may indicate a problem with the sensor include:

GM: Code 33 (too high frequency) and Code 34 (too low frequency) on engines with multiport fuel injection only, and Code 36 on 5.0L and 5.7L engines that use the Bosch hot-wire MAF, if the burn-off cycle after shut-down fails to occur.

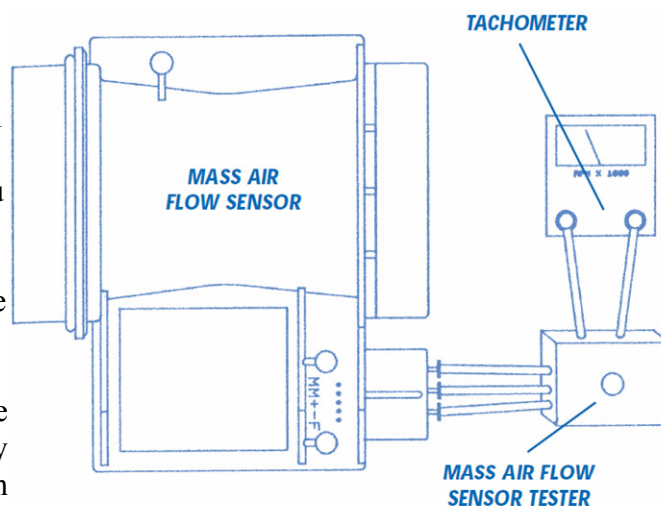
Ford: Code 26 (MAF out of range), Code 56 (MAF output too high), Code 66 (MAF output too low), and Code 76 (no MAF change during "goose" test).

Of course, don't overlook the basics, such as low engine compression, low vacuum, low fuel pressure, leaky or dirty injectors, ignition misfire, excessive back-pressure (plugged converter), etc., since problems in any of these areas can produce similar driveability symptoms.

TESTING

MAF sensors can be tested either on or off the vehicle in a variety of ways.

You can use a MAF Sensor Tester and tachometer to check the sensor's response. If testing on the vehicle, unplug the wiring harness connector from the sensor and connect the tester and tachometer. Start the engine and watch the readings. They should change as the throttle is opened and closed. No change would indicate a bad sensor. The same hookup can be used to test the MAF sensor off the vehicle. When you blow through the sensor, the readings should change if the sensor is detecting the change in air flow.



Another check is to read the sensor's voltage or frequency output on the vehicle. With Bosch hot-wire MAF sensors, the output voltage can be read directly with a digital voltmeter by backprobing the brown-and white output wire to terminal B6 on the PCM. The voltage reading should be around 2.5 volts. If out of range, or if the sensor's voltage output fails to increase when the throttle is opened with the engine running, the sensor may be defective. Check the orange and black feed wire for 12 volts, and the black wire for a good ground.

Power to the MAF sensor is provided through a pair of relays (one for power, one for the burn-off cleaning cycle), so check the relays too, if the MAF sensor appears to be dead or sluggish. If the sensor works but is slow to respond to changes in air flow, the problem may be a contaminated sensing element caused by a failure in the self-cleaning circuit or relay.

(Con't on page 10)

Getting the Flow of MAF Sensors (con't from page 9)

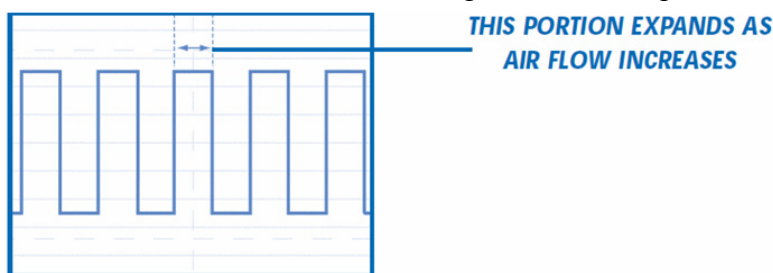
With GM Delco MAF sensors, attach a digital voltmeter to the appropriate MAF sensor output terminal. With the engine idling, the sensor should output a steady 2.5 volts. Tap lightly on the sensor and note the meter reading. A good sensor should show no change. If the meter reading jumps and/or the engine momentarily misfires, the sensor is bad and needs to be replaced. You can also check for heat-related problems by heating the sensor with a hair dryer and repeating the test.

This same test can also be done using a meter that reads frequency. The older AC Delco MAF sensors (like a 2.8L V6) should show a steady reading of 32 Hz at idle to about 75 Hz at 3,500 rpm. The later model units (like those on a 3800 V6 with the Hitachi MAF sensor) should read about 2.9 kHz at idle and 5.0 kHz at 3,500 rpm. If tapping on the MAF sensor produces a sudden change in the frequency signal, it's time for a new sensor.

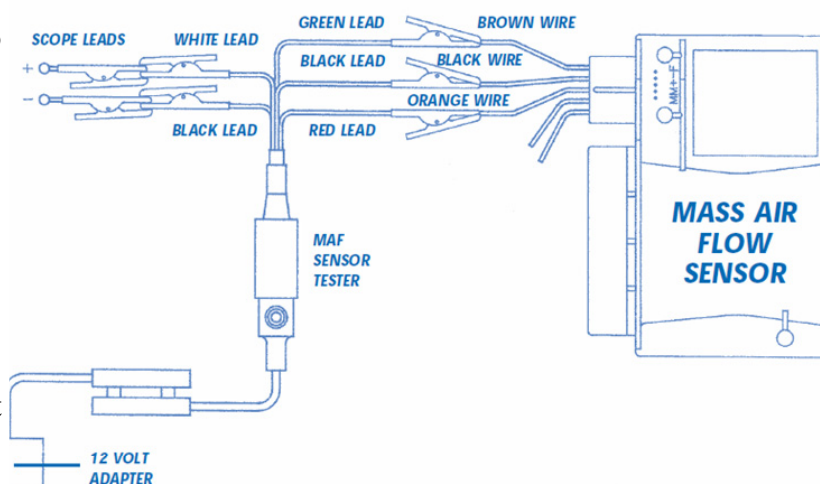
On GM hot-film MAFs, you can also use a scan tool to read the sensor's output in "grams per second" (gps), which corresponds to frequency. The reading should go from 4 to 8 gps at idle up to 100 to 240 gps at wide-open throttle.

Like throttle position sensors, there should be smooth linear transition in sensor output as engine speed and load change. If the readings jump all over the place, the computer won't be able to deliver the right air/fuel mixture and driveability and emissions will suffer. So you should also check the sensor's output at various speeds to see that its output changes appropriately.

Another way to observe the sensor's output is to look at its waveform on a scope. The waveform should be square and show a gradual increase in frequency as engine speed and load increase. Any skips or sudden jumps or excessive noise in the pattern would tell you the sensor needs to be replaced.



Yet another way to check the MAF sensor is to see what effect it has on injector timing. Using an oscilloscope or multimeter that reads milliseconds, connect the test probe to any injector ground terminal (one injector terminal is the supply voltage and the other is the ground circuit to the computer that controls injector timing). Then look at the duration of the injector pulses at idle (or while cranking the engine if the engine won't start). Injector timing varies depending on the application, but if the mass air flow sensor is not producing a signal, injector timing will be about four times longer than normal (possibly making the fuel mixture too rich to start). You can also use millisecond readings to confirm fuel enrichment when the throttle is opened during acceleration, fuel leaning during light load cruising and injector shut-down during deceleration. Under light load cruise, for example, you should see about 2.5 to 2.8 Ms duration.



Your Most Valuable Tool to Fix TRANSMISSIONS



Thousands of transmission shops and general repair facilities worldwide count on the experienced staff and resources at ATSG to help them get the job done right and on time. All of ATSG's certified technicians have years of hands-on experience and are available to answer your tech problems on both foreign and domestic automatic transmissions.

In addition to our Technical Hotline, ATSG offers the latest Books, Software, Bulletins, Seminars and Technical Courses to the Automatic Transmission Professional.

So, stop turning away transmission repair work! ATSG is here to help you solve all your automatic transmission repair problems.

Call us today at (800) 245-7722

or visit us online at
www.atsg.biz

Try our pay per call option.

Become a Member Today & Take Advantage of...

- Our huge library which exceeds any single shop's library.
- Our "Superior Technical Hotline" which outranks the rest.
- 10 knowledgeable technicians which are there to assist you with any problems.
- The savings we provide by solving your transmission problems. One answered question can surpass the value of your subscription fee.



Expert Help is Just a Phone Call Away.



**MEMBERSHIP
PROVIDES**

**MONTHLY
SEMINARS
@ A \$35
DISCOUNT**

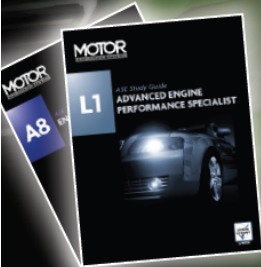
**CERTIFICATE
OF
MEMBERSHIP**

**CERTIFICATE
OF
ATTENDANCE
&
Hands-on
Certification**

NEUTRONICS, INC.



NEUTRONICS, INC.



GOT GUIDES?

MOTOR ASE Study Guides: Preventative Maintenance for ASE Testing

You wouldn't skip it on your vehicle - don't skip it for your certification.
Order Your Study Guides Today!



*Recertifying in Multiple Areas? Save Money & Buy The Entire Set!**



*C1 Automobile
Service Consultant*

Available individually or as a set* for the eight basic automotive technician ASE certifications: A1 - A8, L1 Advanced Engine Performance Specialist and C1 Automotive Service Consultant. Each guide contains self-study material along with test questions at the end of each chapter, sample test with answers & glossary of terms.

** C1 Automobile Service Consultant Not Included in Set, Sold Separately*

- A1 Engine Repair
- A2 Automatic Transmissions and Transaxles
- A3 Manual Drivetrains and Axles
- A4 Suspension and Steering
- A5 Brakes (Also available in Spanish)

- A6 Electrical and Electronic Systems
- A7 Heating and Air Conditioning
- A8 Engine Performance
- C1 Automobile Service Consultant
- L1 Advanced Engine Performance Specialist

MOTOR
INFORMATION SYSTEMS



ORDER FORM

Qty	Product	List Price	TOTAL
_____	ASE Study Guide Set (A1-A8)	\$120.00	\$ _____
_____	ASE Advanced Study Guide Set (A1-A8 & L1)	\$140.00	\$ _____

TST MEMBERS PRICES:

ASE Study Guide Set (A1-A8), **\$85**
 ASE Study Guide Advanced Set (A1-A8, L1), **\$100**
 Get them at TSTseminars.org or call (845) 628-6928

**Automotive Test Solutions
presents our 4th**

**MOTOR TOP 20
TOOL WINNER!**



**Detects Misfires and then Checks the Mechanical Condition
of the Engine in Just **Minutes!****

Automatically Find:

- **Cylinder Misfires**
- **Random Misfires**
- **Bank Misfires**

**Checks
Camshaft Timing
Through The
Spark Plug Hole!**

Automatically Diagnose:

- **Camshaft Timing Problems**
- **Broken or Weak Valve Springs**
- **Bad Valves or Valve Guides**
- **Piston Sealing Problems**
- **Intake Gasket Leaks**
- **Ignition Timing**
- **Dirty Valves**



**Checks
Misfiring Cylinders
Through The
Exhaust Pipe!**



**To celebrate our
4th Motor Top 20 Tool award
we are offering TST members a**

****\$400** discount on the**

****E**MISSFIRE DETECTOR **Kit****

Only **\$2995⁰⁰**

1 • 800 • 572 • 6112

www.AutomotiveTestSolutions.com



**Automotive
diagnostic
Power User
tools**



Double-insulated 12pc Tool Set \$367.85

AES# CM-ITS-12B-AES

Tested to 10,000 VAC and rated for 1,000 VAC. Provides you with an extra level of protection. Custom kits available!

Fluke i400 AC Current Clamp \$94.00

AES# F-i400

Single range 400 A ac current clamp compatible with multimeters.

HV Glove Kit (Class 0) AES# Glove Kit \$89.95

Sizes 8-12

The first line of protection for you.

Fluke SureGrip™ Stray Voltage Adapter Test Lead Kit \$69.00

AES# F-TL225

Eliminates stray voltages!

Fluke 1587 Insulation Multimeter \$499.00

AES# F-1587

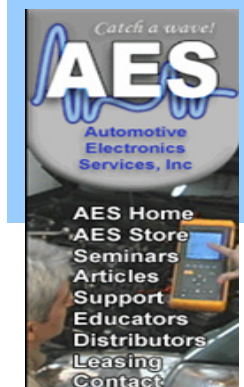
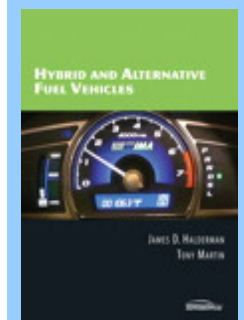
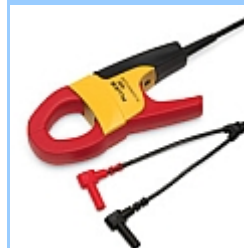
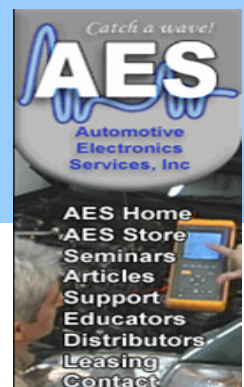
- CAT III 1000V
- CAT IV 600V
- Insulation test voltages 50V, 100V, 250V, 500V, 1000V
- Insulation test: 0.01 meg ohm to 2.0 meg ohm
- Auto discharge of capacitive voltage
- Insulation test smoothing ...

Hybrid and Alternative Fuel Vehicles \$89.00

AES# PH-20

By James Halderman

Covers Batteries and Battery Service, Motors, Generators, Controls, Regenerative Braking, First Responder and Safety Procedures, Hybrid Vehicle Diagnostic Trouble Codes and more.



www.AESWAVE.com

***877 351-9573 Ask for Carlos or Mario for
a TST Discount of 5 % on all orders***