Gas Analyzer Usage

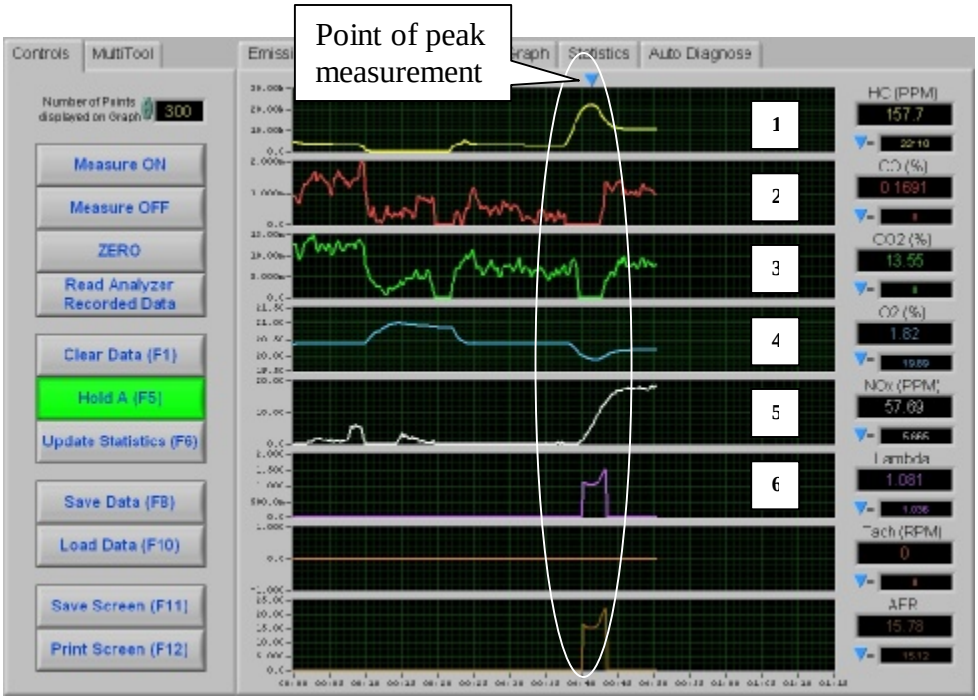
By Bob Pattengale, PWR Training

1993 Mitsubishi with no spark, fuel ok

My favorite way to use an exhaust gas analyzer is on no start vehicles. Using an exhaust gas analyzer lets me determine within a few seconds if there is fuel or spark.

1. Insert the sample probe into the tailpipe.
2. Crank the engine over, attempting to start the vehicle. 10 to 15 seconds of cranking time should be sufficient.
3. Watch the exhaust gases on the display or if available use the gas analyzer software to record the data.
4. Analyze the data to determine the cause of the no start.

Figure 2 is a screen capture of the Automotive Test Solutions (ATS) Emissions software from a 1993 Mitsubishi with no spark and fuel ok. The blue arrow on the right at the top of the first graph marks the peak measurement point.



1. Yellow – Hydrocarbons (HC): We expect to see greater than 7000 ppm. On this vehicle we have more than 20,000 ppm. This indicates the engine is getting fuel.

2. Red – Carbon Monoxide (CO): If spark is present we expect to see CO rise. We do not have sufficient space in this article to cover gas theory, but here is the short version. The engine is expecting to receive 14.7 lbs. of air and 1 lbs. of hydrocarbon fuel. If the fuel and air went through the engine without a spark or combustion event, you would still have raw HC's and air. In order for CO to exist, the raw HC must be broken apart into individual parts, hydrogen and

carbon. This breakdown occurs with compression and spark. The carbon and oxygen combine to make CO. In this example, no spark was present, so we have no CO.

3. Green – Carbon Dioxide (CO2): If spark (combustion) is present we expect to see CO2 rise. The same description from CO applies for CO2.

4. Blue – Oxygen (O2): If spark is present we expect to see some of the oxygen used as part of the combustion process. In this case the O2 passed through the engine un-effected. To verify what your oxygen content is for you altitude, check the O2 reading with the sample probe out of the tailpipe. In Tucson, AZ we expect to see approximately 20% O2. I expect the O2 to be less than 20% if spark (combustion) is present.

5. White – Oxides of Nitrogen (NOX): This is not a high priority for a no start condition.

6. Purple – Lambda: In a start-up condition, we expect to see an air/fuel mixture that is a little richer, the lambda reading should be at or below 1.0. In this example, Lambda was approximately 1.0, so the proper amount of air and fuel were delivered. We have already determined no ignition spark exists. If Lambda goes higher than 1.0 the air/fuel mixture is lean. If Lambda goes lower than 1.0 the air/fuel mixture is too rich.

Final conclusion in this case, fuel delivery does not seem to the cause so focus your diagnosis on the lack of combustion. The next logical step would be to check for spark.

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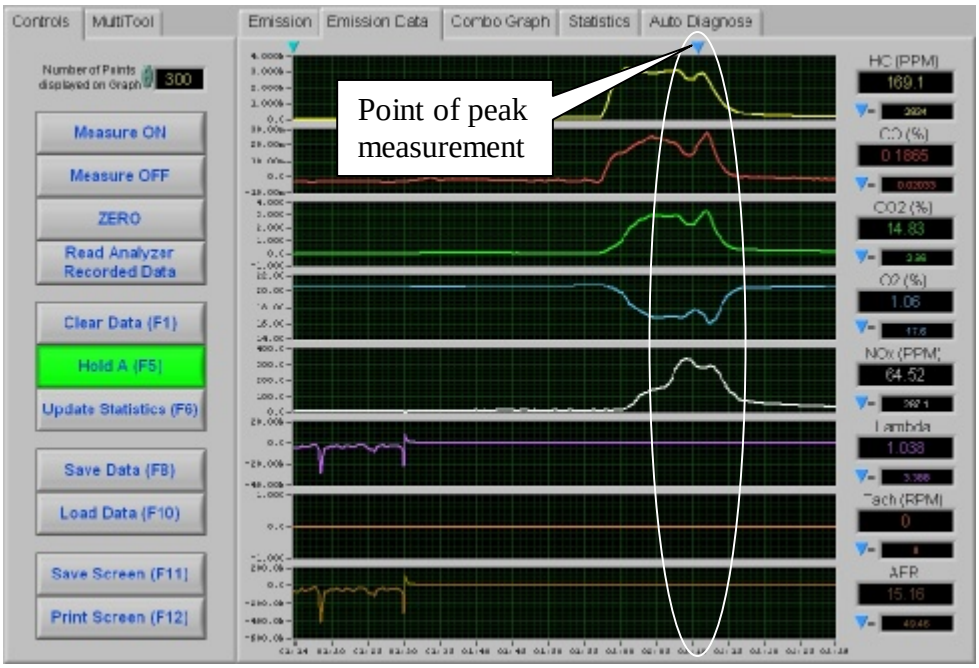
1993 Chevy with low fuel pressure

Figure 3 is a capture from 1993 Chevy with spark and low fuel pressure. Using the description from above, we see the peak HC's are approximately 3000 ppm well below the 7000 ppm threshold. CO and CO2 increased, so a combustion/spark event occurred. O2 dropped to 16.8%, so the engine is pumping O2 and O2 was used in the combustion process. Lambda increase to 3.0 which verifies the air/fuel mixture was lean.



The conclusion? Look for a source of low fuel availability. This can be done by looking at the display, and as you can see the graphing clearly shows the relationships.

Exhaust gas analyzers can be used to diagnose other vehicle systems. Here are a few suggestions:

1. Evaporative emission system operation.
2. Evaporative emission system leaks.
3. Fuel odors in and around the vehicle.
4. No-Start conditions.
5. Engine combustion gases in the cooling system.
6. Air injection emission systems.
7. Exhaust system leaks.
8. More...

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If you don't have an exhaust gas analyzer or need to replace an older unit, AES offers two very good gas analyzers from Automotive Test Solutions (ATS) and Emissions Systems (EMS):

ATS 5-Gas Analyzer

Link: http://www.aeswave.com/products/Product.asp?i=623

- Displays six items, including air/fuel ratio, lambda or RPM.
- Includes a water separation unit for high moisture environments.
- Integrates with ATS E-scope and E-ignition

EMS 5-Gas Exhaust Analyzer

Link: http://www.aeswave.com/products/Product.asp?i=452

- Displays four items.
- Lambda is displayed with optional wireless PDA or PC software.

Both companies offer PC software and have excellent displays. What makes these units good for everyday usage is the excellent filtration systems (see below). The ATS unit includes a water separation unit for high moisture environments.

If you do not have an exhaust gas analyzer, you are missing out on a very powerful diagnostic tool. I am confident that you will reduce your diagnostic time using an exhaust gas analyzer, which ultimately will mean more money in your pocket at the end of the day.

Catch a Wave!