Happy New Year!

From Arizona TPI

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High-Tech Tuning

For most of us, all we really want from our car's engine is for it to run really well, make great power and get excellent gas mileage. Not a lot to ask for, right? Well, maybe it is, but making sure your engine is getting the right air fuel ratio will go a long way towards making your dream of the perfect engine a reality.

So what is this air fuel ratio? The air fuel ratio, or AFR is the amount of air that is mixed with the fuel that enters the engine. For example, if you had a 5:1 AFR, there would be 5 times as much air as fuel in the mixture entering the cylinder.

So, what's the "right" AFR for my engine? As often is the case in these articles, the answer is: "it depends." There is a term, stoichiometric, which describes the ideal combustion process where the fuel is burned completely. For gasoline stoichiometric will occur with an AFR of 14.7:1 at sea level. This means that 14.7 parts of air are mixed with 1 part of gasoline and, during combustion, all the fuel will be burned completely.

At a stoichiometric AFR an engine will run the most efficiently. But, at stoichiometric, the engine won't make the most power and it won't idle its best if the engine has a performance camshaft that causes an uneven idle.

For maximum power, most naturally aspirated engines will do best with an AFR of around 13:1 and with forced-induction engines such as those with superchargers and turbochargers, an AFR of 12.5:1 or even richer often works best. The interesting part about using an especially rich mixture in forced induction applications is that the excess fuel ends up helping to cool the cylinder to minimize detonation which, in those applications, can destroy an engine very quickly.

The air fuel ratio turns out to be a very important factor in how an engine runs, but how do you know what AFR your engine is experiencing under different loads? The traditional way was to run the engine under different conditions and then pull the spark plugs and study the electrodes to determine if the engine is running rich, lean or just right. There is, however, an easier and much more accurate method of determining this information. Air fuel ratio meters, using a wide-band oxygen sensor are the preferred way of determining the AFR of an engine. Many of these devices can record this information as the car is driven, which can be very useful for tuning

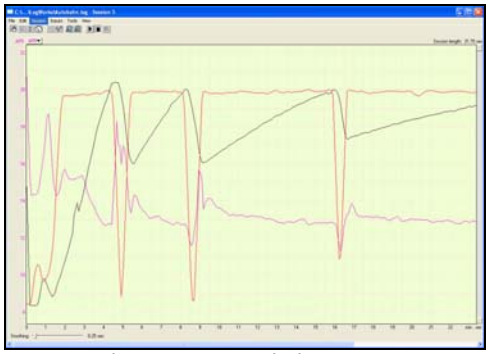
We at Arizona TPI have recently added the Innovate Motorsports LM-1 Digital Air Fuel Ratio Meter to our inventory. This is probably the most popular of these types of devices and we have been using one in our shop for years for all types of tuning and diagnostic tasks.

LM-1 Digital Air Fuel Ratio Meter

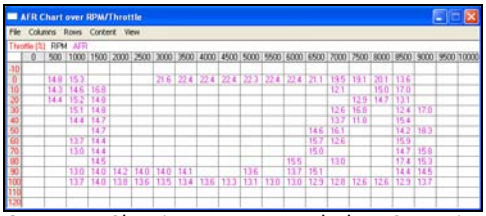
The LM-1 can be used with both carbureted and fuel injected vehicles to determine the exact air fuel ratio under any conditions. Pictured above is the basic kit, which we sell for $349.95. In the shop, we use the RPM kit ($429.95) which has an additional cable that can be used to wire in a tach signal as well as up to six other sensors. This allows the LM-1 to monitor the AFR in conjunction with engine RPM and other data such as engine load from the MAP sensor, engine temperature, etc.

Obviously, this is the most useful for fuel-injected engines where the AFR can be adjusted for different RPM ranges and load levels. However, the LM-1 is still very useful when determining the appropriate jet sizes for a carbureted vehicle.

The really useful thing about the LM-1 is that it will record AFR data while the vehicle is being driven, up to 40 minutes. This data can then be downloaded to a PC and analyzed in several different formats. This information is extremely useful, especially when using the RPM kit where various engine parameters can be recorded. This allows the recording of a ¼ mile run when tuning for maximum performance, or just driving around town when pinpointing a drivability problem.



Graph From Recorded LM01 Data



Summary Chart From Recorded LM01 Data

For engine tuning, this is an invaluable tool. They're in stock in our store and you can check them out on our website!

Arizona TPI is Hiring!

At Arizona TPI, our business has been increasing. Because of that, we are looking for another technician who has a good knowledge of fuel injection systems. The majority of our business involves installing, diagnosing, repairing and tuning fuel injection systems. But that's not all we do. We do disk brake conversions, engine swaps and engine rebuilds, among other things.

If you or someone you know is looking for a challenge and would like to join the Arizona TPI team, give us a call!

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