

**** K&N AIR/FUEL MONITOR INFORMATION ****

- NOTE -

Please read all instructions before installing or using your K&N Air/Fuel Monitor.

These instructions are for the following air/fuel monitor kits and/or accessories:
85-2437 - Rectangular Monitor Complete Kit (includes sensor and weld-on fittings)
85-2441 - Round Monitor Complete Kit (includes sensor and weld-on fittings)
85-2439 - Rectangular Monitor only
85-2442 - Round Monitor only
85-2438 - Oxygen Sensor only (includes weld-on fittings)

Instructions specific to a particular kit or assembly will be noted by part number.

The K&N Air/Fuel Monitor is a precision instrument designed to help performance enthusiasts calibrate an optimum air/fuel mixture ratio. This device will work on carbureted, injected, supercharged or turbocharged engines using unleaded gasoline, alcohol, propane or nitrous oxide. It will not work with nitromethane or diesel fuels. Using the instrument to monitor the engine's air/fuel mixture ratio, a tuner can adjust for power, economy and/or improved drivability.

To "read" the air/fuel mixture, the system uses an oxygen sensor to sample the exhaust gas. The sensor "sniffs" the exhaust and measures the amount of oxygen present in the spent gases. When used as part of a computer controlled feed-back system, the oxygen sensor tells the computer (via a small electric signal) when the air/fuel ratio is rich, lean or just right. The computer reacts to the signal by re-calibrating the fuel delivery system thousands of times per second. This feedback control loop, or "closed-loop" system maintains a near perfect air/fuel ratio throughout the entire operating rpm range. Your K&N Air/Fuel Monitor uses this same electric signal to illuminate a group of 10 LED lights that correspond with an air/fuel ratio scale. Reading the scale will tell if your fuel calibration is rich, lean or just right. Using the Monitor as a tool, a tuner can adjust for peak performance, economy and/or drivability under any load condition or throttle setting.

The monitor reads oxygen left in the exhaust regardless of what fuel is used, so the number of lights and the corresponding scale remains the same.

The first K&N Air/Fuel Monitors required 1.2 volts to light all 10 red lights (120 millivolts per light). Current monitors have red, yellow and green lights and require 100 millivolts per light. The revision was necessary since the current oxygen sensors generate a maximum of 1-volt.

Your K&N Air/Fuel Monitor has many uses. For example, it can be used as a guideline for preparing a vehicle for emissions testing or as a piece of dynamometer test equipment.

Refer to the graph in Figure 1 to calculate the amount of carbon monoxide (CO) and hydrocarbon (HC) emissions as related to the air/fuel ratio. As indicated by the chart, leaning the air/fuel mixture reduces CO and HC emissions.

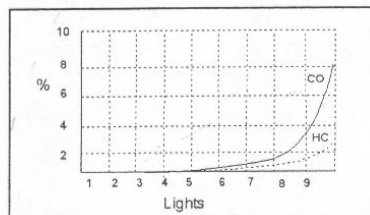


Figure 1

The monitor becomes an invaluable tool when used with either an engine or chassis dynamometer. For example, during a recent chassis dyno session, a vehicle was tested in stock form and then re-tested with a prototype velocity stack mounted on the carburetor. The Air/Fuel Monitor indicated the most desirable horsepower curve as each of the carburetor's fuel circuits were adjusted. A dip in horsepower at 2500 rpm indicated a lean fuel condition. Enriching the midrange fuel delivery circuit alleviated the problem. Unfortunately, peak power also dropped slightly, reminding us that most carburetor adjustments result in compromise. Decreasing the main jet size restored the horsepower as the monitor indicated a return to an optimum air/fuel mixture ratio.

The Air/Fuel Monitor can also be a helpful tool when setting the idle mixture screws on an engine equipped with a large camshaft and automatic transmission. Chock the wheels, start the engine and put the transmission in drive. Adjust the idle mixture screws until the 8th light on the Monitor glows steady. The engine should then idle in drive without stalling.

Installing an oxygen sensor in each exhaust pipe is an excellent way to confirm a fuel distribution problem. If you would like to monitor both banks, install a second oxygen sensor in the other pipe. Then switch between the sensors with a switch (purchased locally).

The voltage output of the oxygen sensor is not linear (see Figure 2) so the reading may occasionally bounce back and forth between lights 3 and 7. This condition is considered normal and does not indicate a radical change in the air/fuel ratio. Note that the sensor is very accurate near 14.7:1.0 and less accurate as the air/fuel ratio goes either rich or lean.

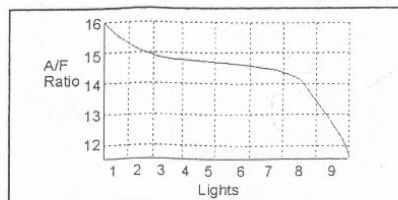


Figure 2

**** NOTICE ****

The oxygen sensor in your K&N Air/Fuel Monitor assembly is not compatible with leaded fuels or any fuel additive containing lead.

Leaded fuel will contaminate the oxygen sensor causing it to deliver a false reading. The Monitor can, however, be used to momentarily test an engine burning leaded fuel. Simply install the sensor - re-calibrate the fuel delivery system to deliver the desired air/fuel ratio - then remove the sensor to avoid prolonged exposure. Short term exposure will extend the useful life of the sensor, but eventually it will become contaminated. Once contaminated, the sensor must be replaced to restore the accuracy of your instrument. Additionally, since there is no efficient way to test the sensor, there is no way to determine the level of contamination. Therefore, we recommend periodically comparing a used sensor to a new one.

Other products that will contaminate or clog the sensor are: - gas/oil mixture - octane boosters containing lead - injector or carburetor cleaners contain lead additives - or other "secret potions".

**** HEATED OR NON HEATED OXYGEN SENSORS ****

All oxygen sensors must be heated to at least 600 degrees F before they will deliver an accurate signal. There are two types of sensors. Non heated sensors must be warmed by the hot exhaust gas. Heated EGO sensors contain an internal heating element which brings the sensor to full operating temperature usually within 60 seconds. K&N 85-2437 and 85-2441 Air/Fuel Monitor kits include a non-heated sensor. For most customers, the cost of a heated sensor, the electrical accessories necessary to make it functional and the added labor needed to wire the unit, can not be justified considering the normal warm up time for a non-heated sensor is from 8 to 12 minutes. The replacement 85-2438 oxygen sensor is the same non-heated sensor included in the kits.

**** INSTALLATION ****

The monitor should be mounted as close as possible to the instrument cluster and in convenient full view of the driver. Use the adjustable mount to accommodate the location. The monitor can be used as a hand held tester by simply using a 9-volt battery as a source of power. The sensor must be grounded to the battery for proper operation.

Vehicles With Existing Oxygen Sensor

Computer controlled vehicles are already equipped with an oxygen sensor. Unless you would prefer a complete "stand alone" monitoring system, connect an 85-2439 or 85-2442 to the vehicle's existing sensor. If you would rather have a stand alone system, purchase an 85-2437 or 85-2441 and follow the instruction under "Vehicles Without Oxygen Sensor." Installing a monitor will provide a "real time" reading as you drive. Simply connect the white wire leading from the K&N Monitor to the white wire leading from the factory oxygen sensor. Do not splice into the sensor's pigtail harness. Do not splice into the shielded cable/wire leading from the sensor to the connector. Splice ahead of the connector in the vehicle's wiring harness. Splice the black ground wire leading from the monitor to the black wire in the wiring harness leading to the stock oxygen sensor. Once the red lead is connected to a switched power source, the Monitor will "read" your real time air/fuel mixture ratio. NOTE: If your vehicle is equipped with a heated oxygen sensor (three-wire or four-wire sensor), check with the vehicle manufacturer or consult a wiring diagram for your specific vehicle to learn which wire is the correct wire. Some sensors have a ground wire in the pigtail (wiring harness), others do not. Because some manufacturers shield the sensor wire in the pigtail, splice into the wiring harness, not the pigtail.

Vehicles Without Oxygen Sensor

Pre-computer controlled vehicles are not equipped with a factory installed oxygen sensor. It will then be necessary to install the sensor included in either the 85-2437 or 85-2441 kit. Locate a suitable location for the oxygen sensor on the vehicle's exhaust system. The ideal location is in the exhaust pipe as close as possible to the last exhaust port. The closer proximity to the exhaust port, the quicker the sensor will reach operating temperature - usually within 20 seconds. The sensor will also maintain normal operating temperature even under low-load conditions.

If the vehicle is equipped with headers, position the sensor in the collector where all of the tubes come together. If the vehicle is equipped with cast iron exhaust manifolds, position the sensor in the pipe just below the manifold. Either driver's or passenger's side pipe is acceptable. Weld the 18mm threaded boss to the pipe or collector. Make sure there is sufficient room for the sensor once it is installed. Drill a 3/4-inch hole through the pipe or collector using the boss as a guide. Apply anti-seize compound to the threads of the sensor before installing it the boss.

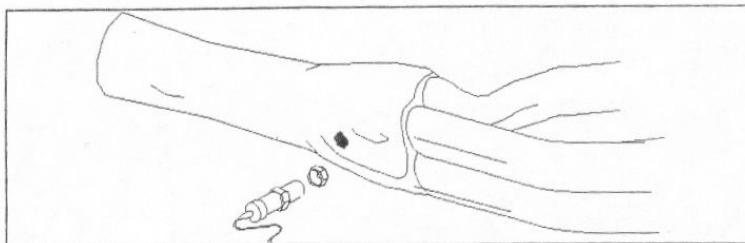


Figure 3

Electrical Connections

1. Connect the monitor red wire to a switched power source (9-12 volts).
2. Connect the monitor black wire to the negative battery terminal or other ground source.
3. Connect the monitor white wire to the oxygen sensor. It is essential the monitor and the sensor be grounded either through the chassis or a separate wire. If the power source is the cigarette lighter, connect a supplemental ground wire to both the receptacle and the sensor.

- Problem:** Power supply on - engine off. The monitor does not light.
Solution: Check the power supply with a test light or other suitable instrument. Check to insure the black wire is attached to a suitable ground. The monitor has a check system circuit when power is supplied. If 2 or 3 lights are not lit when power is applied, the monitor is defective. Call our service department at (800) 858-3333 to receive instructions for replacement.
- Problem:** Only one or two lights are functional when the engine is running at full operating temperature.
Solution: Check the connections to the sensor. If using a remote battery to power the monitor, check both power and ground connections. It is possible the sensor is located too far away from the heat source. If so, the monitor will read correctly when cruising, but will cease to function properly when at idle. If the sensor can not be moved closer to the cylinder head, it will be necessary to install a heated sensor.
- Problem:** The monitor reacts sluggishly or renders a lean reading under normal conditions.
Solution: The sensor is contaminated or clogged. The sensor is not compatible with leaded fuel or additives containing lead. If exposed to lead for a prolonged period, replace the sensor. There is no warranty on oxygen sensors.
- Problem:** The monitor indicates a rich air/fuel ratio under normal conditions.
Solution: This can indicate a mechanical problem. Have the ambient conditions changed (altitude, temperature, humidity)? Does the air filter need to be serviced? Is the carburetor or throttle body clean? Is the choke operating normally? Burned engine oil from leaky rings or bad valve seals can cause the sensor to read rich.
- Problem:** The monitor indicates a lean air/fuel ratio under normal conditions.
Solution: If the power source for the monitor is a cigarette lighter, ground the black wire leading from the monitor to the sensor body. Additionally, exhaust leaks, water injection, internal water leaks from a cracked head or leaky head gasket, smog pumps, fuel additives and/or poor mechanical condition can contribute to a leaner than normal reading.
- Problem:** The lights are erratic and will not stabilize.
Solution: This is not a problem, but rather a condition. A reading in between the defined increments used to scale the meter will show as a flickering light. It simply means the mixture is not strong enough to fully illuminate the next light. The voltage output of the oxygen sensor is not linear (see Figure 1) so the reading may occasionally bounce back and forth between lights 3 and 7. This condition is considered normal and does not indicate a radical change in the air/fuel ratio. Note that the sensor is very accurate near 14.7:1.0 and less accurate as the air/fuel ratio goes either rich or lean. Caution: A lean fuel condition can melt pistons and/or burn valves. An under-sized or worn fuel pump, fuel lines that are too small or an inadequate fuel pump pickup tube can also cause a lean fuel condition when the engine is under full power. Make sure the fuel delivery system exceeds the engine's needs.
- Problem:** The lights go out when the accelerator is depressed.
Solution: Check all electrical connections. Check for adequate voltage at the monitor. Check to insure all ground connections are secure. A severe lean fuel condition such as a fuel pump failure, vapor lock, non-functional accelerator pump or some other problem that will cause fuel starvation will also cause the lights to go out. Take appropriate measure to immediately correct the situation before attempting future testing.
- Problem:** The reading does not reflect calibration changes.
Solution: Take care not to make two changes at once. For example, adding higher octane fuel or changing brands and adjusting the fuel pressure regulator counts as two changes. A drastic change in ambient conditions can reflect a slower than normal reading. Is the operating temperature of the engine the same? Did the adjustment truly consummate a change? Was the change significant or subtle? Fine tuning within a tenth of a percent will not always change the reading. If the monitor still seems "numb" check and/or replace the sensor.
- Problem:** The lights do not light sequentially.
Solution: If any light will not illuminate or if the lights read from right to left, the monitor is defective and should be returned to K&N. Call for a return authorization number.

- NOTE -

Because your Air/Fuel Monitor uses a mass produced oxygen sensor which allows for a range of acceptable tolerance, it can not deliver the same level of accuracy provided by a piece of expensive laboratory test equipment. Oxygen sensors are very accurate near 14.7:1 ratio and less accurate as the air/fuel ratio goes either rich or lean. Therefore, it should not be assumed the Monitor will issue data that would allow the user to dial in a "perfect" air/fuel ratio for power or economy. The instrument should be used to monitor your air/fuel mixture and/or to "dial in" the best possible overall ratio.

Also note the range of the Monitor is limited to 16.1 lean to 12.1 rich (gasoline). Race engineered engines can exceed the rich limits of the sensor. Once all ten lights are lit, your reading is off the scale.

Instructions For Replacing Oxygen Sensor

- Cut the pigtail wire attached to the new sensor as shown. - Attach the white wire from the Monitor to the new sensor. - Seal using heat shrink tubing to create a water-tight connection.

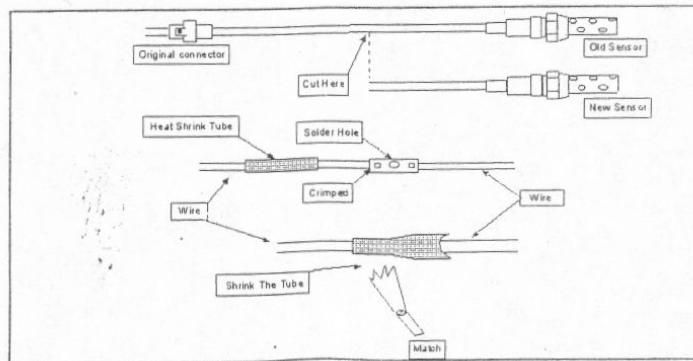


Figure 4