LambdaLink

System Description

Oxygen sensors (Lambda Probes) are self generating sensors that produce a small output voltage according to the oxygen content of the exhaust gas. Higher amounts of exhaust oxygen indicate a lean mixture, and produce a small output voltage. Rich mixtures produce very little oxygen and the output voltage is higher. This voltage range is amplified and scaled by the display unit to drive an LED bar-graph calibrated to both air/fuel ratio and carbon monoxide (CO).

Sensor Types

There are many variations of Lambda Probes although all are identical in terms of the output signal. The principle differences are mostly physical involving mounting methods, heated or unheated and tolerance to contamination, especially lead.

Mounting Most probes use a standardised M18 x 1.5 metric thread designed to screw into a mating boss, usually in the exhaust manifold. Some variants use a bolted flange arrangement, but these are relatively uncommon.

Heaters Many probes incorporate an electrical heating element which is powered by the vehicles 12 volt supply. These heaters allow the probe to be mounted in cooler portions of the exhaust system and significantly improve the probe performance at idle and during warm up phases of operation, the probe temperature must exceed 300ºC before accurate readings are possible. Heated probes are identified by having three wires (sometimes four) instead of a single output wire.

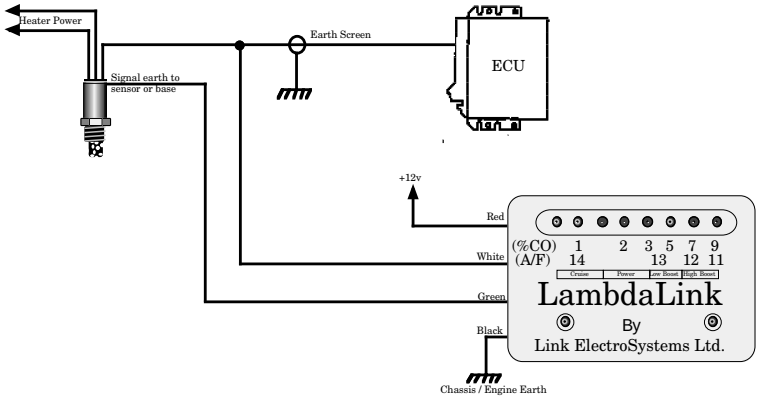
Lead Tolerance The lead additives used in most high octane (super) fuel will contaminate the probe over a period of time resulting in eventual probe failure. Lead tolerant probes are available and must be used if long term exposure to leaded fuel is likely. The tolerant probes are more expensive than standard units, but otherwise identical in operation.

Sensor Mounting

Most EFI engines will have a Lambda probe installed as original equipment in the exhaust manifold or turbo housing, if applicable. They are usually heated and the heater wiring connection should be retained in all cases. The probe will be connected to the vehicle ECU (computer) to provide a feed back signal for closed loop operation. The LambdaLink may be “piggy backed” onto the output wire for monitoring purposes. Do not cut the signal wire to the ECU but tap into the wire as shown below. The output wire will often be screened so it will be necessary to carefully cut back the screen (outer braiding) in order to access the inner signal wire. This is best done at the probe connector where a small section of unbraided wire exists. The following points should be noted:

1. The Green wire MUST be connected to the engine block rather than to a chassis or battery negative earth. The return signal of the probe (probe body) is via the exhaust manifold / engine block assembly and will not read accurately if an alternative earth is used for this wire. The black earth wire (display earth) may be

connected to any convenient earth point. DO NOT be tempted to splice the two wires and run a single earth. They MUST be run separately.



2. The signal wire from the probe must be routed well clear of HT leads, coil and other ignition components. The output signal of the probe is very small and easily interfered with by the ignition system (hence the screened cable normally used).

3. The input impedance of the display unit is very high and should not affect the factory ECU under normal conditions. If some interaction is suspected then it may be necessary to mount a second probe dedicated to the display and leave the factory sensor wiring unmodified.

Non Factory Installation

For after market applications it will be necessary to manufacture a sensor mount according to engine type and layout. The preferred position is in the exhaust manifold (highest temperature) although any location in the exhaust may be used provided the probe is adequately heated. Note that not all probe heaters were create equal, some are considerably more powerful than others ranging from about 7 to 18 watts. Probes of Japanese origin tend to have lower powered heaters and should be located as close as practical to the manifold. European probes (eg. Bosch) tend to have higher heater power. The lead tolerant versions tend to have higher heater power which continue to work right to the tail pipe. The following table summarises some of the more common types:

Bosch	P/N 0 258 003 050	(unleaded fuel)	
	white wires	=	heater (12 watts)
	black wire	=	signal (+)
	body	=	signal (-)
Bosch	P/N 0 258 003 070	(leaded fuel)	
	white wires	=	heater (18 watts)
	black wire	=	signal (+)
	body	=	signal (-)
Bosch	P/N 0 258 104 002	(leaded fuel)	
	white wires	=	heater (18 watts)
	black wire	=	signal (+)
	grey wire	=	signal (-)

Note: A very high quality probe, although expensive

Nissan	P/N A24 - 601 110 49262 (unleaded fuel)		
	red and black wires	=	heater (8 watts)
	white wire	=	signal (+)
	body	=	signal (-)
	Note: Although basically a unleaded probe they do seem rather lead tolerant. Note low heater power.		
Honda	P/N ND 065500-8210	(unleaded fuel)	
	black wires	=	heater (7 watts)
	white wire	=	signal (+)
	green wire	=	signal (-)
	Note: An unusual "floating" type sensor. There is no electrical connection to the body, hence the additional green (-) signal wire.		

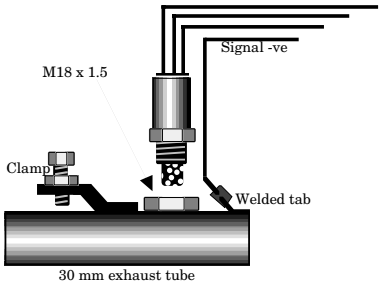
Tail Pipe Installation - Available from Supplier

A tail pipe adapter may be purchased or manufactured for temporary installation for quick checks and tuneups. This has the obvious advantage of being applicable to all vehicles without the need to weld mounting bosses in often difficult locations. Speed of operation is still very high, virtually instantaneous. The actual style of adapter is not critical but note the following points.

1. The probe must have a high powered heater (18 watts) in order to function. Suggest the Bosch 0 258 003 070 which is also lead tolerant.

2. The Green (signal -ve) wire from the display MUST run back to the probe body, separate to any other heater earth wiring.

3. Ensure that only the exhaust gases are passing the sensor. Any air leaks into the sampling tube will produce errors due to the presence of atmosphere oxygen.



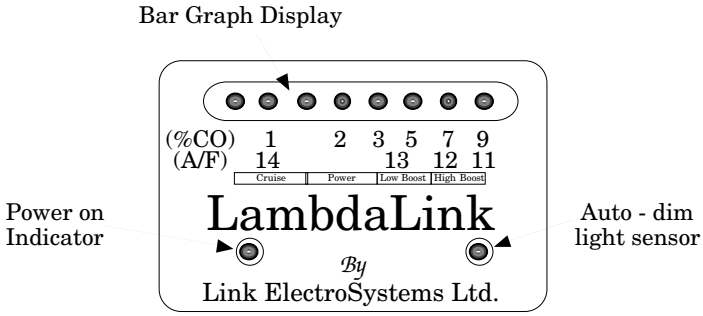
Caution:

Lambda Probes use ceramic material internally and are susceptible to impact damage. Handle probes carefully to avoid impacts at all times.

Display Unit

The display uses a colour coded LED bar graph to display the probe signal. The internal amplifier and scaling electronics use only the upper portion of the sensor range since this represents the active tuning range for most engines. The display features an auto dim

function to prevent dazzle when using the display at night and also provides faint background illumination to make the scale easier to read under low light conditions. A separate (green) LED serves as a "power on" indicator.



Display Scaling

Three scales are shown below the LED bar graph for reference purposes:

Carbon Monoxide (CO) Ranges from 1% - 9% CO. This is the most common form of "mixture" expression in current usage and allows cross referencing to regular exhaust gas analysis.

Air / Fuel Ratio (A/F) Ranges from 14:1 to 11:1. This form of "mixture" expression is somewhat dated being superseded by CO.

Label Blocks Shows the approximate operating areas for those not keen on numbers.

Operating Notes

1. Very lean mixtures (below 1% CO) will not be displayed. Very few engines will run with any degree of stability at such lean mixtures.

2. Ignition misfires and incomplete combustion will result in large amounts of exhaust oxygen causing the display to misread (show lean). Generally this effect will show as abrupt lean outs (rapid down scale movement) as opposed to a more gradual drop for a generally lean condition. Engines running "hot cams" at low RPM will show considerable flutter on the display due to the poor combustion these cams produce, so idle readings are usually invalid. The display should read correctly once the engine RPM increases.

3. The importance of connecting the Green sensor -ve wire to the engine block or probe body can not be over emphasised. Differences of as little as 0.1v between "earth" points will produce significant errors so take care.