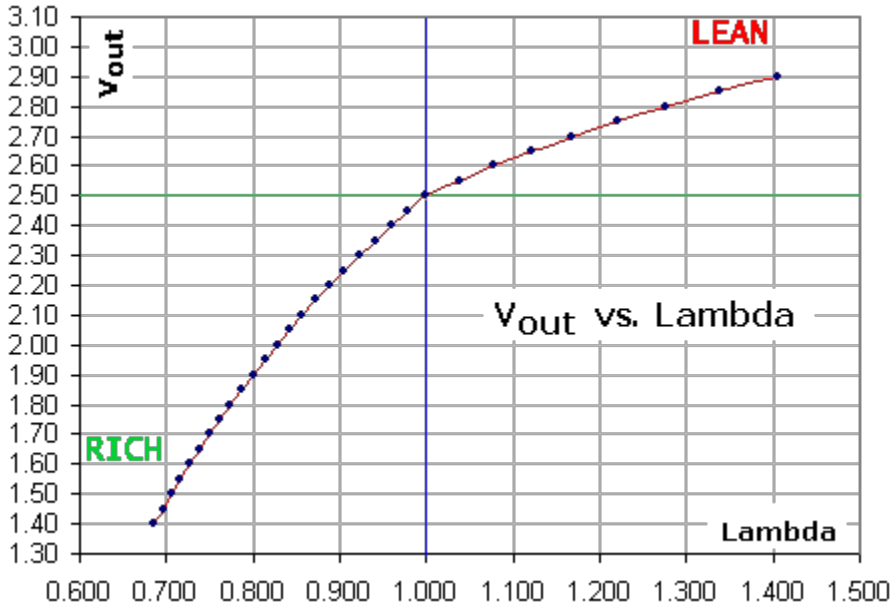
DIY-WB Data

This document describes some of the DIY-WB unit's operating characteristics. It is important to note that the unit is built using high tolerance components **but has no internal adjustments**. Some variation is therefore expected between each unit due to component tolerances and aging of both the sensor and the unit itself.

V_{out} vs. Lambda



This graph shows the DIY-WB's **Vout** voltage against **Lambda**. The Lambda measure is independent of the hydrocarbon fuel being used.

The **stoichiometric point** is where all the available oxygen has combined with all the available fuel leaving no free residual oxygen. The stoichiometric point is shown on the graph as the **vertical blue line** at lambda of 1.00.

The **stoichiometric output voltage** is nominally **2.50 Volts** and this point is shown as the **horizontal green line** that crosses the blue line at a lambda of 1.00.

Lambda and AFRs for different fuels

This table show the DIY-WB unit's measured **Lambda** against the **Vout** voltage which is available at pin 7 of the male DB9 connector (pin 6 = GND).

Note that **Lambda** is a ratio of ratios and is **1.0 exactly** at the **stoichiometric** point for **any** given fuel. This table shows the **approximate AFRs** for a number different common fuels.

As fuel compositions are seasonal and regional, the AFRs shown here should be considered only as approximate.

The free-air Vout point of 4.00 volts is interesting from a number of viewpoints. The free-air voltage will vary a little from location to location as there will be differing trace concentrations of various hydrocarbon fuels in the atmosphere.

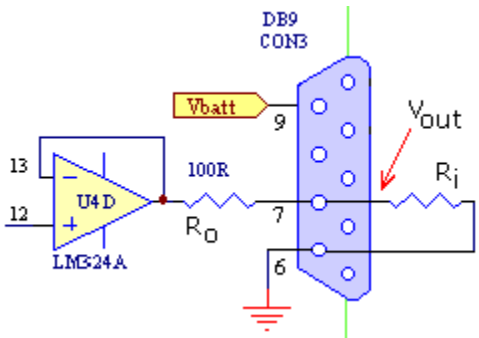
V_{out}	Lambda	Petrol	LPG	Methanol	Diesel
1.40	0.686	10.08	10.63	4.39	9.94
1.45	0.696	10.23	10.79	4.45	10.09
1.50	0.706	10.38	10.94	4.52	10.24
1.55	0.716	10.53	11.10	4.58	10.39
1.60	0.727	10.69	11.27	4.65	10.54
1.65	0.739	10.86	11.45	4.73	10.71
1.70	0.750	11.03	11.63	4.80	10.88
1.75	0.762	11.20	11.81	4.88	11.05
1.80	0.774	11.38	12.00	4.95	11.23
1.85	0.787	11.57	12.20	5.04	11.41
1.90	0.800	11.76	12.40	5.12	11.60
1.95	0.814	11.96	12.61	5.21	11.80
2.00	0.828	12.17	12.83	5.30	12.00
2.05	0.842	12.38	13.05	5.39	12.21

The free-air point can be used to calibrate the DIY-WB unit for a particular sensor that has aged or is not close enough to 4.00 Volts using the original calibration resistor that is built into the sensor's 8 pin Sumitomo connector.

As noted above, the basic WB unit's Vout may vary slightly from the specifications shown here. The stoichiometric Vout of 2.50 may be a little higher or lower (+/- 0.03 Volts) and the free-air Vout may be a little higher or lower than 4.00. It's worth noting that the most important calibration value is to get the **difference between the stoic Vout (2.50) and free-air (4.00)** to be as **close as possible to 1.50 Volts** so that the interesting tuning AFR range (AFRs of between 10 and 15 for petrol) are then most accurately represented. When this 1.50 volt specification is achieved, and the unit's offset from the nominal 2.50 volt stoic value is compensated for, quite reliable AFR values can be obtained from the unit.

2.10	0.857	12.60	13.29	5.49	12.43
2.15	0.873	12.83	13.53	5.59	12.66
2.20	0.889	13.07	13.78	5.69	12.89
2.25	0.905	13.31	14.03	5.79	13.13
2.30	0.923	13.57	14.31	5.91	13.39
2.35	0.941	13.84	14.59	6.03	13.65
2.40	0.960	14.11	14.88	6.14	13.92
2.45	0.980	14.40	15.18	6.27	14.20
2.50	**1.000**	**14.70**	**15.50**	**6.40**	**14.50**
2.55	1.037	15.25	16.08	6.64	15.04
2.60	1.078	15.84	16.70	6.90	15.62
2.65	1.121	16.48	17.38	7.17	16.26
2.70	1.169	17.18	18.11	7.48	16.95
2.75	1.220	17.93	18.91	7.81	17.69
2.80	1.276	18.76	19.78	8.17	18.50
2.85	1.337	19.66	20.73	8.56	19.39
2.90	1.405	20.66	21.78	8.99	20.38
			. . .		
4.00	**free-air** (can be used for calibration)				

Input Impedance, V_{out} and the Real World

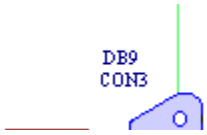


It is important to understand that the Tech Edge wideband unit (like any real world device) has a non-zero output impedance (**Ro**). Any device the wideband unit is connected to for the purposes of logging Vout will have a non-infinite input impedance (**Ri**). This means that there will be small differences between the logged voltage (as seen by an ECM, etc.), and the voltage produced by the wideband unit. Generally if the logging device has an input impedance greater than 100 k ohms then this effect can be ignored. If the input impedance is 30 k or less then it starts to make a noticeable difference between the actual and logged voltages (and hence measured AFR values).

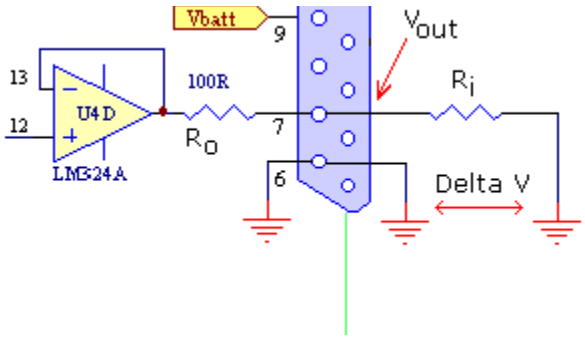
We have created an eXcel spreadsheet to help you build a custom table of Vout vs. AFR - See voutnew.xls. You supply the output impedance **Ro** of the wideband unit (**1,000** for version 1.0 and **100** for version 1.1/1.5) and the input impedance **Ri** of your device. A graph is automatically generated.

Many people may not know the input impedance of their logger (or ECM, etc.) but it can be determined by noting when half of an applied voltage is "lost" across a resistor in series with the voltage.

Offset Voltages, V_{out} and the Real World



A further complication is that sometimes there will be a large enough difference in voltage between the logging device (ECM, etc.) GROUND point and the Wideband unit



itself, that errors start to become apparent. These differences in GROUND potential are simply a fact of life that result from non-zero resistance between different GROUND points - this causes measured voltage differences when currents flow.

These differences in voltage are normally called offset voltages and they tend to remain fixed for a given installation (or vary with some stimulus such as switching on headlights, etc). Offset voltages tend to be a little tricky as they may be different for what otherwise looks like the same installation.

Previous | Oz DIY-WB Home | **Order** Oz DIY-WB parts/units | Copyright

logo

Last updated **15 th Mayt** 2003
Created 17th August 2002 | *Tell me about broken links*

Previous | Home | Feedback | Copyright