SPILBA

User manual

AIR/FUEL RATIO

Wideband

User manual V2.0

Contents

Introduction

The Spilba WB O2 equipment accurately determines the exhaust gas mixture over a wide range of engine operating conditions with a fast response. The device is designed to be quickly installed and used easily.

Its size, along with the high-quality Motorsport connectors and robust anodized aluminum housing, allow for very flexible and secure handling or mounting.

It can be powered by a wide range of voltages in extreme environments and allows for the use of the latest generation BOSCH 4.2 or 4.9 sensors.

This manual helps understand how to connect and operate the gauge.

Connections

Enclosure connector

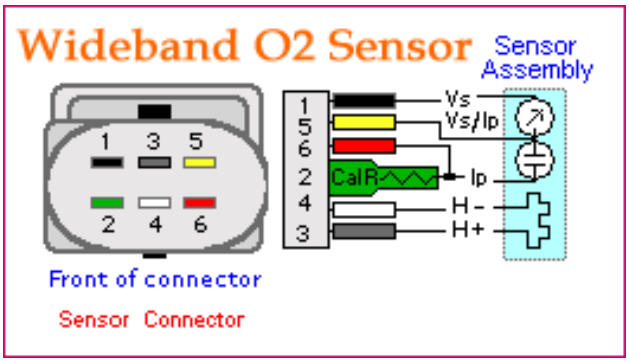
The WB O2 has a 12-pin male Amphenol connector that corresponds to the female connector on the connection hose provided with the equipment.

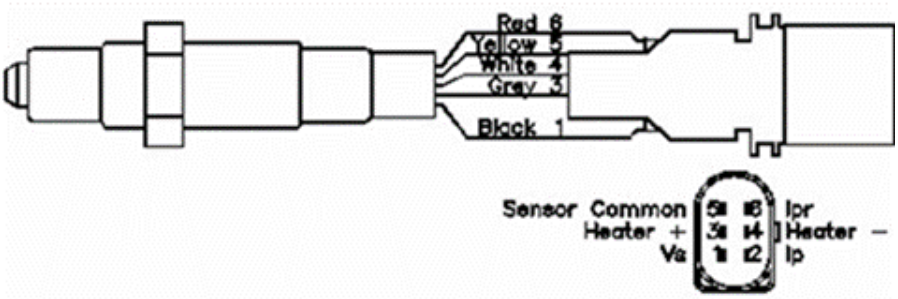
Connection hose

Sensor connector (spark plug)

The cable harness provided with the equipment includes a connector that allows it to be linked to the Bosch 4.2 or 4.9 sensor

The connection scheme with the signal designations is detailed in the following figure.





Power connection:

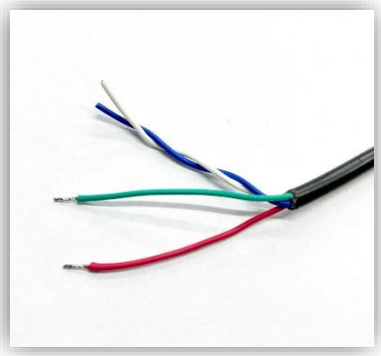
The connection harness features two pairs of cables without terminals:

Green: GND

Red: Power supply

Blue: Analog - (GND)

White: Analog + (Output)

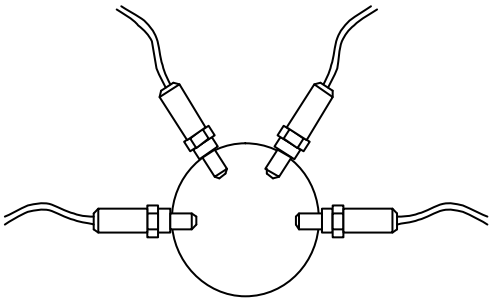


Configuration button

Finally, at the end of the remaining cable of the harness, there is the button that allows selecting the different display modes.

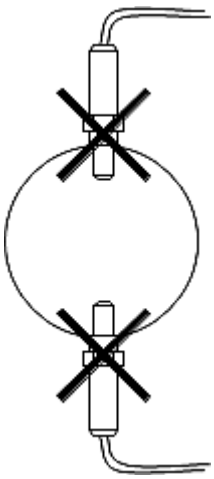
Probe installation

The Bosch 4.2 or 4.9 probe should be placed in the exhaust system of each vehicle with the tip protruding into the gas flow. The probe should have an angle between 10 and 90 degrees from the vertical, with the tip pointing downwards. This ensures that water condensation does not accumulate between the metal casing and the ceramic. It should not be placed vertically due to excessive heat in this position.



Correct probe placement

Incorrect probe placements

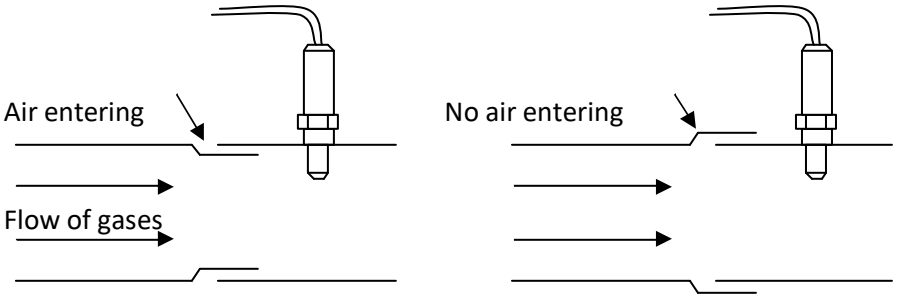


It is recommended that whenever possible, the probe should be placed at least 1 m away from the exhaust valves to avoid excessive temperature and 1 m away from the end of the exhaust pipe to prevent contamination with atmospheric oxygen. This is not mandatory, and if necessary, it can be placed closer to the engine in short exhaust systems.

The probe's location should ensure that it is far from any deflagration from the cylinder head and in areas where gases from a single cylinder are **dominant.**

Slip joints in the exhaust should be avoided near the sensor as some designs allow air to enter. In these cases, the joints can be reversed to make them compatible with the sensor's use.

Design of slip joints to avoid incorrect readings:



Startup

Preliminary steps:

To start up the equipment, it is necessary to follow the following sequence of steps:

1. Connect the provided hose to the equipment using the circular connector.
2. Connect the Bosch probe using its connector.
3. Connect the power cable to the power source. Remember that the green cable should be connected to ground and the red to the positive of the power source.
4. Optionally, you can use the analog output to connect the indicator to an external data acquisition systems or even an ECU, using the corresponding BLUE/WHITE pair.

Powering on

When the equipment is turned on, it will display the logo on the screen and then a sequence of information until finally indicating the lambda reading.

When the mode change button is pressed, the screens display the desired values.

Probe heating

The internal heater in Bosch probes is sufficient to allow accurate measurements, even if the gas is at room temperature. The Bosch LSU probe takes approximately 20 seconds to heat up before taking a reading.

The maximum continuous operating temperature is 850 degrees. It should be avoided to use the sensors for prolonged periods above this temperature. The sensor can be used for short periods (less than 10 minutes) up to 930 degrees, but its accuracy decreases.

Lambda

The Lambda reading provides a measure of the air-fuel ratio that is independent of the type of fuel used.

Lambda 1.0 corresponds to the stoichiometric ratio, meaning when there is no excess fuel or air.

Lambda > 1.0 => Excess Air (Lean Mixture)
Lambda < 1.0 => Excess Fuel (Rich Mixture)

Lambda can be directly converted into the air-fuel ratio using a multiplicative factor. The SPILBA WB O2 allows you to observe either of these mixture reading forms using the configuration button.

A conversion table between both values for various fuels can be found in the appendix.

Probe lifespan

The lifespan of the sensor depends on the type of fuel used and the flow of gases over the sensor. The probe can be contaminated by sealants used in the exhaust pipe. Suitable sealants should be used for this type of application.

Lead-based fuels substantially reduce the lifespan due to sensor element contamination. Typically, in high-performance engines, the sensor should operate for about 500 hours with unleaded fuel and 50 hours with leaded fuel. The lifespan is considerably longer in less demanding applications.

At the end of its lifespan, the sensor will respond more slowly and will not accurately indicate rich mixtures. For street vehicles, Bosch LSU probes are designed to be accurate for up to 50,000 km, so the above figures for competition equipment are a very conservative estimate.

The sensor's lifespan is reduced by contaminants such as lead, oils, silicon, etc. Thermal cycling also leads to premature aging, as does exposure to exhaust fumes if the heating control is not functioning (for example, the sensor is not connected to the WB O2).

Specifications

Power Supply, Consumption, and Operating Conditions	
Supply Voltage	+9 a +24V DC
Current Consumption	80 mA typical (+sensor heater current)
Protections	Voltage inversion
Operating Temperature	-25 ºC ~ +70 ºC

Lambda probe	
Compatible Prober=s	Bosch LSU 4.2 / Bosch LSU 4.9
Maximum exhaust temperature	850 ºC
Normal temperatura range	150 – 800 ºC

Measured values	
Lambda on 4.2 probes	0.7 - 9.99 λ
Lambda on 4.9 probes	0.65 - 9.99 λ
Air/Fuel Ratio (AFR) in 4.2 probe	10.29 – 147 AFR
Air/Fuel Ratio (AFR) in 4.9 probe	9.44 – 147 AFR
Accuracy	+/- 1.5% (Probe specific)

Analog output	
Voltage Values	0 – 4.5 V
λ Values	0.7 – 1.28 λ

Display	
Type	OLED
Dimension	1.54 in

Appendix

Lambda vs. Air/Fuel Ratio

Lambda (λ)	Air/Fuel Ratio			
	Gasoline	**Alcohol**	**LPG**	**Diesel**
0.70	10.3	4.5	10.9	10.2
0.75	11.0	4.8	11.6	10.9
0.80	11.8	5.1	12.4	11.6
0.85	12.5	5.4	13.2	12.3
0.90	13.2	5.8	14.0	13.1
0.95	14.0	6.1	14.7	13.8
1.00	14.7	6.4	15.5	14.5
1.05	15.4	6.7	16.3	15.2
1.10	16.2	7.0	17.1	16.0
1.15	16.9	7.4	17.8	16.7
1.20	17.6	7.7	18.6	17.4
1.25	18.4	8.0	19.4	18.1
1.30	19.1	8.3	20.2	18.9
1.35	19.8	8.6	20.9	19.6
1.40	20.6	9.0	21.7	20.3
1.45	21.3	9.3	22.5	21.0
1.50	22.1	9.6	23.3	21.8
1.55	22.8	9.9	24.0	22.5
1.60	23.5	10.2	24.8	23.2