



# FuelTech



## WB O<sub>2</sub> NANO

Wideband Lambda Sensor Conditioner

Installation and Operation Guide

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## 2. Presentation

The FuelTech WB-O<sub>2</sub> Nano is a tool used for monitoring and datalogging of air to fuel ratios on combustion engines. This equipment conditions and reads the Bosch LSU 4.2 wideband O<sub>2</sub> sensor quickly and accurately.

The Nano features an extremely compact package size with a integrated waterproof connector and CAN communication capabilities to communicate with the Power FT ECU's with a minimum of wiring. This CAN communication allows your analog inputs (white wires) to remain un-touched in the event you desire to use multiple O<sub>2</sub> monitors on the same setup over CAN.

The display displays Lambda values well as error messages.

The WB-O<sub>2</sub> Nano uses FuelTech's Advanced Self-Calibration Software, a technology that makes the lambda readings much more precise, and allows the reader in the lambda sensor to compensate for errors in the readings caused by the aging or fatigue of the lambda sensor. Moreover, it uses a Bosch processor, which calibrates automatically through the sensor connector's original laser calibration resistor, dismissing the need for calibration by the user.

### 2.1 Characteristics

- Water proof (IP67 Certified)
- Lambda readings shown on the display (5.14 to 146.9 AFR Gas)
- CAN communication with Power FT ECU's
- Analog output 0-5V (8.7 to 16.2 AFR Gas)
- It is possible to change the analog output values to 5.14 to 17.6 (Gas) or 9.55 to 19.11 AFR or 9.55 to 58.80 AFR or yet 9.55 to 146.9 AFR (Gas).
- Dimensions: 2 3/8" x 1 3/4" x 1 7/16"

### 2.2 Package contents

- WB-O<sub>2</sub> Nano module
- Wiring harness (optional)
- Template for fixation holes
- Instructions manual
- 4 screws for fixation
- FuelTech sticker



#### NOTE

*O<sub>2</sub> sensor wiring harness are available in two lengths, 78" and 178"*

### 3. Warnings and Warranty Terms

The use of this equipment implies the total accordance with the terms described in this manual and exempts the manufacturer from any responsibility regarding to product misuse.

Read all the information in this manual before starting the product installation.

**This product must be installed and programmed by specialized auto shops and/or personnel with experience on engine preparation and tuning.**

Before starting any electric installation, disconnect the battery.

The inobservance of any of the warnings or precautions described in this manual might cause engine damage and lead to the invalidation of this product warranty. The improper adjustment of the product might cause engine damage.

This product does not have a certification for the use on aircrafts or any flying devices, as it has not been designed for such use purpose.

In some countries where an annual inspection of vehicles is enforced, no modification in the original fuel injection system is permitted. Be informed about local laws and regulations prior to the product installation.

#### Limited Warranty

All products manufactured by FUELTECH are warranted to be free from defects in material and workmanship for one year following the date of original purchase. Warranty claim must be made by original owner with proof of purchase from authorized reseller.

This warranty does not include sensors or other products that FUELTECH carries but did not manufacture. If a product is found defective, such products will, at FUELTECH's option, be replaced or repaired at cost to FUELTECH. All products alleged by Purchaser to be defective must be returned to FUELTECH, postage prepaid, within one year warranty period.

This limited warranty does not cover labor or other costs or expenses incidental to the repair and/or replacement of products or parts.

This limited warranty does not apply to any product which has been subject to misuse, mishandling, misapplication, neglect (including but not limited to improper maintenance), accident, improper installation, tampered

seal, modification (including but not limited to use of unauthorized parts or attachments), or adjustment or repair performed by anyone other than FUELTECH.

The parties hereto expressly agree that the purchaser's sole and exclusive remedy against FUELTECH shall be for the repair or replacement of the defective product as provided in this limited warranty. This exclusive remedy shall not be deemed to have failed of its essential purpose so long as FUELTECH is willing and able to repair or replace defective goods.

FUELTECH reserves the right to request additional information such as, but not limited to, tune up and log files in order to evaluate a claim.

**Seal violation voids warranty and renders loss of access to upgrade releases.**

Manual version 1.7 – September/2021

## 4. WB-O<sub>2</sub> Meter Nano Electric Installation

The WB-O<sub>2</sub> Nano has a 12-way connector with 3 wire groups. One of them has the connector for the O<sub>2</sub> sensor, the second makes the CAN communication with Power FT ECU's and the third is responsible for power and analog output.

By default, the analog output is set to values of 8.7AFR to 16.2AFR Gas, but can be configured to 5.14AFR to 17.6AFR Gas or 9.55 to 19.11AFR or 9.55 to 58.80AFR or yet 9.55 to 146.9AFR (Gas), if necessary.

See the following wiring diagram for details about connections.

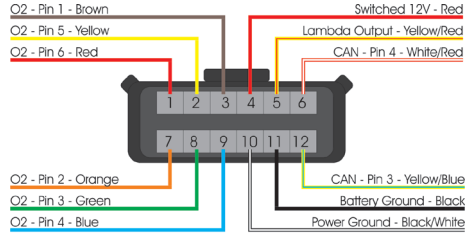
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### 12-way connector

Wire color	Pin	Connection	OBS
Red	1	O <sub>2</sub> sensor	O <sub>2</sub> sensor pin 6 - IP
Yellow	2	O <sub>2</sub> sensor	O <sub>2</sub> sensor pin 5 - sensor negative signal
Brown	3	O <sub>2</sub> sensor	O <sub>2</sub> sensor pin1 - Sensor positive signal
Red	4	Switched 12V	The use of a 10A fuse is recommended
Yellow/Red	5	0-5V Analog Output	Analog output proportional to the lambda readings. Used for connection with data acquisition systems
White/Red	6	CAN	CAN (+): connected to Power FT ECU's CAN port
Orange	7	O <sub>2</sub> sensor	O <sub>2</sub> sensor pin 2 - sensor resistor calibration
Green	8	O <sub>2</sub> sensor	O <sub>2</sub> sensor pin 3 - sensor heater positive
Blue	9	O <sub>2</sub> sensor	O <sub>2</sub> sensor pin 4 - Sensor heater negative signal
Black/White	10	Chassis/ Engine Power Ground	Engine ground (head/block) <b>Do not connect it directly to the battery negative.</b>
Black	11	Battery's Negative	Connected <b>directly</b> to the battery negative with no splices. <b>Do not connected this wire to the chassis engine block or head.</b>
Yellow/Blue	12	CAN	CAN (-): connected to Power FT ECU's CAN port

# WB-O2 Nano

## 4.1 Electrical Wiring Diagram



Harness Connector Rear View

## EN 4.2 Four WB-O2 Nano harness

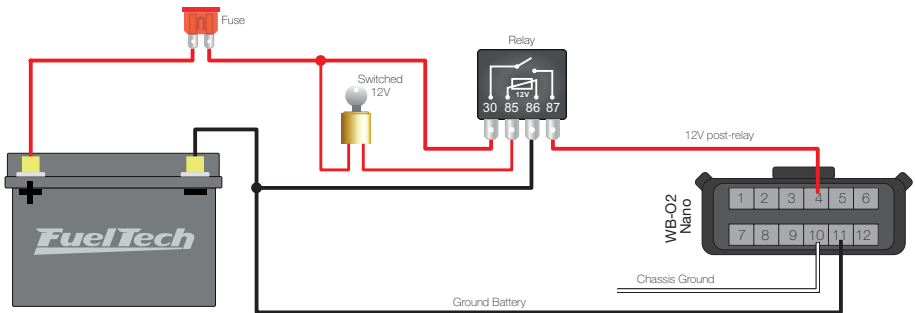
This harness was developed to power up to four WB-O2 Nano readers and four wideband O2 sensors, for builds needing individual fuel reading per cylinder.

Electrical connections and wire colours are the same as a regular WB-O2 Nano.



## 4.3 Electrical wiring WB-O2 Nano standalone

This electrical wiring is used when the WB-O2 Nano is installed in an engine where management is performed by another ECU or even carbureted engines.



## 5. Bosch LSU 4.2 Wideband O2 Sensor

Bosch LSU 4.2 sensor has an encased heating element and it is used to measure the air fuel ratio, which determines the lambda value in the remaining exhaust gas. Its signal indications vary from 5.14AFR Gas (0,35 λ ) lambda (rich mixture) to open air lambda (infinite).

The connector includes a calibration resistor (factory calibrated), which defines the characteristics of the sensor and it is necessary for its operation. It is with this resistor that the WB-O<sub>2</sub> Nano automatically calibrates the sensor.

Bosch LSU Oxygen Sensors are not developed to operate with fuel containing lead, and its life cycle is drastically reduced to an estimated 50 to 500 hours if used in such conditions.

Whenever the sensor is installed in the exhaust and the engine is running, the sensor **MUST** be connected to FuelTech WB-O<sub>2</sub> Nano, which also needs to be in operation. That is to prevent the equipment from being rapidly damaged from exposure to the exhaust gas without heating control.



Bosch Number: 0 258 007 057 or 0 258 007 351  
VW Number: 021-906-262-B

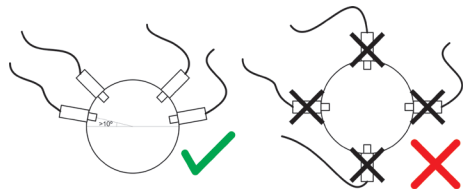
### 5.1 O<sub>2</sub> Sensor Installation

The sensor must be inserted in the exhaust system with its tip exposed to the exhaust gas flow. It must stay in an angle between 10 to 80 degrees to horizontal position, that is, with its end downward, in such a way that steam droplets cannot be accumulated between the body of the sensor and its ceramic part, which could cause damage when the sensor is used. The sensor must not be placed vertically, as it becomes subject to excessive heat.

It is recommended that the sensor is installed at least one (1) meter away from the exhaust manifold to avoid excessive heat, and at least one (1) meter away from the exhaust external output to avoid incorrect readings caused by oxygen in the air outside the exhaust system.

Notice that such recommendations are not obligatory, as vehicles with a smaller exhaust system will need to have the sensor placed closer to the engine.

The sensor must stay away from the cylinder head and from areas where one cylinder might affect the exhaust air more than the others must. Avoid placing the sensor close to the exhaust manifold joints, as some allow the inflow of air, resulting in incorrect readings.



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## 6. CAN Communication

The WB-O2 has CAN communication, which allows the module to send and read information from the Power FT ECU's that are not. Included on the Nano harness are two 4-way CAN connectors that plug and play with other Nano units as well as the Power FT ECU's.

When connected to the CAN port, the WB-O2 Nano can read what the fuel and the measurement unit (lambda or AFR) that the ECU is set, adjusting itself to these settings, disabling the analog output and sending the AFR value to ECU in the range of 5.14 to 149.9 AFR Gas (0,35  $\lambda$  to 9,99  $\lambda$  ).

When used with the FT250 to FT400 range of ECU's you will need to use a 0-5v analog output from the Nano as CAN communication is not possible.

In the CAN network, during the O2 sensor heating period, the value displayed in the Power FT ECU's will be equal to 0 (zero) and the back of lambda gauge will turn yellow.

In case of any error during work, in addition to the warning on WB-O2 Nano display, the error will be sent via CAN to the Power FT ECU's and recorded in "Status Events" log.

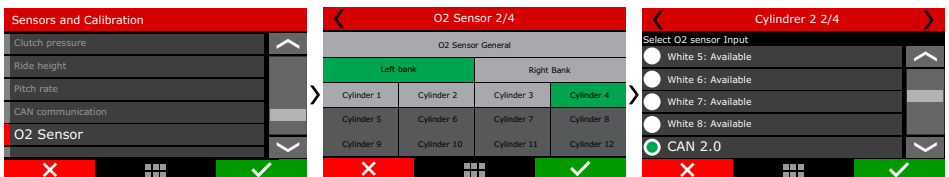
To connect the WB-O2 Nano via CAN to Power FT ECU's simply plug the 4-way cable to the ECU CAN port.

### 6.1 Power FT Line Configuration

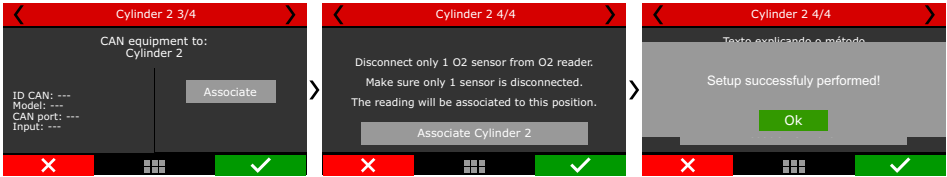
WB-O2 Nano CAN Communication can be setup through FTManager Software or through Power FT ECU's screen.

To setup it through the ECU screen:

Go to "Sensors and Calibration" menu, then "O2 sensor". Select the position where this O2 sensor is installed on the engine. Then for CAN network, select "CAN 2.0".

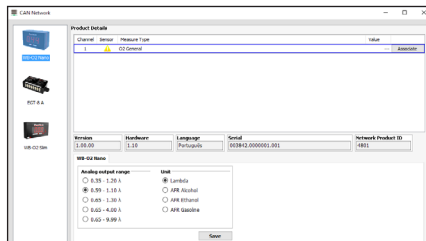


Disconnect the O<sub>2</sub> sensor plug that you want to associate to this position and click “Associate”.



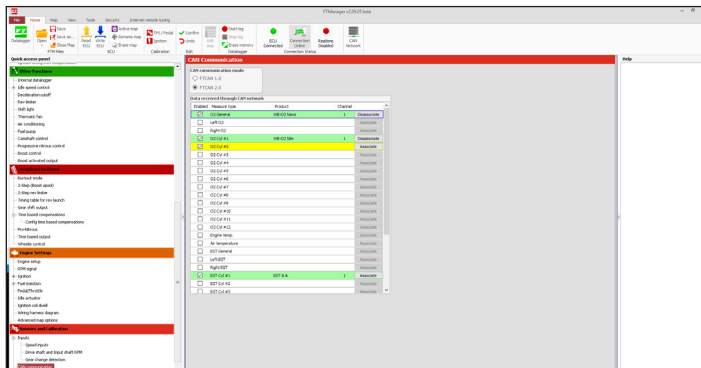
Through FTManager Software:

Click “CAN Network” on the tool bar. All the equipment connected to the CAN Network will be listed on this screen. Right click on the equipment you want to associate and then select the position where it is installed.



The O<sub>2</sub> sensor can also be associated through “Sensors and Calibration” menu, then “CAN Communication”.

To associate an O<sub>2</sub> sensor to a reading, disconnect the O<sub>2</sub> sensor plug and then click “Associate”. If there's one O<sub>2</sub> sensor only connected to CAN network, it is automatically associated when pressing “Associate” button.



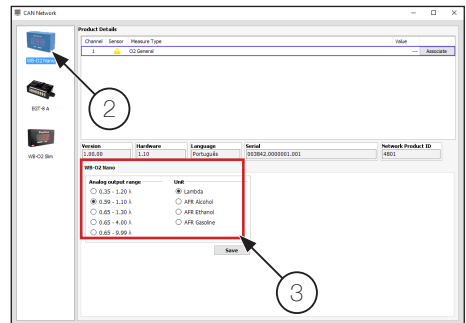
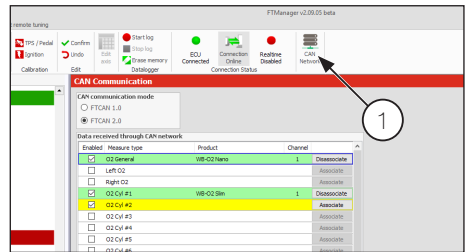
## 6.2 Configuration to use WB-O2 Nano out of the CAN Network

WB-O2 Nano allows the selection of the display unit and O2 sensor reading scale, but, these settings are read from the Power FT ECU's during its initialization. In case it is removed from the CAN network, WB-O2 Nano goes back to factory configuration.

To setup these factory default configurations it is necessary to connect it to a Power FT ECU through CAN network following this procedure:

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- Select an empty map on your ECU (this step is very important in order to prevent your WB-O2 Nano from reading settings from the ECU map);
- Connect the ECU to the USB and WB-O2 Nano to the CAN network;
- Open FTManager Software;
- Click the "CAN network" button on the tool-bar (1);
- Click the photo of the product you want to setup (WB-O2 Nano) (2);
- All the options regarding reading scale and O2 unit will be at the lower part of the screen;
- The options selected in here is automatically sent and recorded as default on the WB-O2 Nano, not being necessary to click save or sand buttons.



### NOTE

*It is recommended to make the configuration of a WB-O2 nano to simplify identification of the network.*

To check if the settings are successfully done, simply turn the WB-O2 Nano off and then on again. The settings will be displayed on its display during startup.

## 7. Lambda Readings analog outputs

### 7.1 Lambda Analog Output in Volts – 5.14 to 17.6AFR

Lambda	AFR Gasolina	AFR Metanol/ Etanol	Volts (V)
0.35	5.14	2.3	0.20
1.20	17.6	7.7	4.80

### 7.2 Lambda Analog Output in Volts – 8.7 to 16.2 AFR (default)

Lambda	AFR Gas	AFR Methanol/ Etanol	Volts (V)
0.59	8.7	3.8	0.20
1.10	16.2	7.1	4.80

### 7.3 Lambda Analog Output in Volts – 9.6 to 19.1 AFR

Lambda	AFR Gas	AFR Methanol/ Etanol	Volts (V)
0.65	9.6	4.2	0.20
1.30	19.1	8.3	4.80

### 7.4 Lambda Analog Output in Volts – 9.6 to 58.8 AFR

Lambda	AFR Gas	AFR Methanol/ Etanol	Volts (V)
0.65	9.6	4.2	0.20
4.00	58.8	25.7	4.80

### 7.5 Lambda Analog Output in Volts – 9.6 to 146.9 AFR

Lambda	AFR Gas	AFR Methanol/ Etanol	Volts (V)
0,65	9,6	4.2	0.20
9,99	149,9	64.1	4.80

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When there is an output reading error, the analog output locks at 0.00V. Thus, it is possible to know if there is any problem or error in the equipment. To configure this output on external equipment, it is necessary to supply the first and last values of the table above.

## 8. WB-O<sub>2</sub> Meter Nano Codes

### 8.1 Informative Codes

When turning WB-O<sub>2</sub> power on, the following information will be displayed:

**Product name**

**Measurement unit (Lambda, AFR gasoline, AFR alcohol or AFR Methanol)**

Analog output scale (as seen on chapter 6)

Cylinder identification (when connected via CAN with Power FT ECU's): tells which cylinder the conditioner is reading, when used for individual cylinder adjustment.

Then the word HEATING indicates the O<sub>2</sub> sensor heating for operation.

After heated, the word HI appears when AFR above 146.9 AFR Gas (64.1 AFR Alcohol) is read.

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### 8.2 Error Codes

Cód	Descriptor	Procedure
E01	E01: internal processor error	It is necessary to send the equipment to FuelTech for repair
E02	E02: Sensor disconnected or damaged	Check connections of the O <sub>2</sub> sensor
E03	E03: Short circuit with the positive on the sensor's heater or damaged heating element	Check connections or replace the O <sub>2</sub> sensor. Check power ground connection
E04	E04: Short circuit with the positive on the sensor's heater or damaged heating element. Power ground problem.	Check connections or replace the O <sub>2</sub> sensor. Check power ground connection
E05	E05: short circuit with the ground on the signal cables or Interference in the O <sub>2</sub> sensor signal cables	Check connections or replace the O <sub>2</sub> sensor. Check power ground connection Check sparks, sparks plugs and cable passageway
E06	E06: short circuit with the positive on the signal cables.	Check connections or replace the O <sub>2</sub> sensor. Check power ground connection
E07	E07: battery voltage under 10V (normal when cranking engine)	Check unit positive and negative connections.
E08	E08: if it blinks during power on, it indicates a communication error. If this code keeps fixed on the screen, may indicate a damaged O <sub>2</sub> sensor or WB-O <sub>2</sub> Nano unit	Try another O <sub>2</sub> sensor. If the problem still unsolved, it is necessary to send the equipment to FuelTech for repair



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