

# Bosch LSU4 Wide Band UEGO Controller

Part Number 220-VM-AF1

## CONFIGURATION

Module Type: AF1

Serial Number:

Output Units:  Lambda  A/F Gasoline  A/F Methanol  \_\_\_\_\_

Channel Name: A/F Cyl 1

Channel Options:

V\_Net ID: A/F Ratio Cyl 1 x310

VNET Update Rate: 50 /second

Sensor Type: Bosch – A/F Units, Gasoline

Logger Sample Rate: 50 /second

Sensor Scaling:

Graph Scaling:

A 0 will become 0

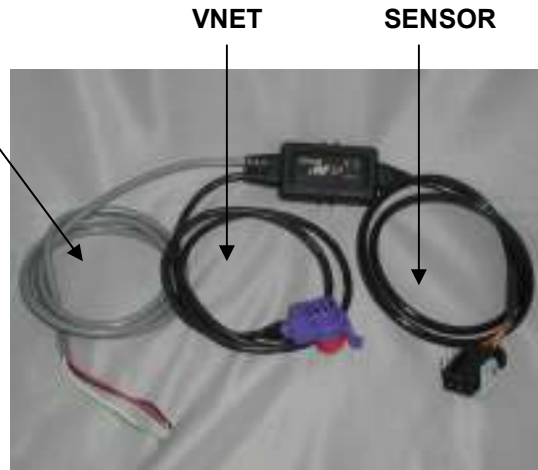
Min Value 10 Max Value 15

B 1 will become 14.7

Digits Before 3 Digits After 2

## POWER AND ANALOG OUTPUT

WIRE COLOR	WIRE FUNCTION
RED WIRE	12V TO 18V POWER
BLACK	POWER GROUND
WHITE	0-5V SIGNAL OUTPUT
GREEN	SIGNAL GROUND
ORANGE	SWITCHED POWER Only required when not using the VNET connection.



### VNET Connection:

Mount the controller in a location that does not expose the module to excessive heat, moisture and vibration. Plug the blue VNET connector in to your data loggers VNET system. This module is compatible with all V-Net Series data logger, except the V50 record/playback module.

### Heater Power Connection

The red and black wires provide power to the sensor heater and controller. The controller can draw up to 2 amps when the heater is running. Connect the black wire to a solid chassis ground and the red wire to constant 12-18 volt power. It is highly recommended that you connect the power on the switched side of the vehicles master power safety switch. You do not need to run the power through an on/off switch in the cockpit. The AF1 controller and sensor heater will automatically turn on and off with the power to your data logger via the VNET cable. If you are not using a Racepak VNET data recorder and/or the VNET connection, you must connect the orange wire to switch 12-18 volt power to turn on/off the AF1 controller. You may leave the orange wire disconnected if you are using the VNET connection.

### IMPORTANT!!

The sensor heater will turn on and draw up to 2 amps of current anytime the power is turned on to your data logger or power is applied to the orange wire.

## Sensor Installation

We recommend installing the sensor in an individual cylinder tube. Mounting the sensor in the collector is not recommended since oxygen can pass back over the sensor during overlap causing lean readings, particularly at low engine RPM. Weld the sensor bung approximately 12 inches from the header flange. Mounting the sensor too close to the exhaust valve can cause the sensor to overheat. To avoid sensor damage from condensation, avoid mounting the sensor on the bottom of the exhaust tube.

### IMPORTANT!!

Do not run the motor for an extended period of time without having the power turned on to the controller. Running the motor without the sensor heater turned on can damage the sensor. If you are not using the sensor remove it from the pipe and use the plug provided with the sensor.

## Analog Output:

If you are installing this module with a Racepak data logger that is VNET compatible, all of the data and communication will be obtained using the VNET connection. However, if you are using an older Racepak data logger that is not VNET capable or another manufacturers data logger you will need to use the 0-5 volt output to get the air/fuel reading from this module. Inside the cable that contains the red and black power wires, there is also a green and a white wire. Connect the white wire to the data loggers 0-5 volt signal input and connect the green wire to the data loggers signal ground. If you are not using the VNET connection you must connect the orange wire to switched 12-18 volt power to turn on/off the AF1 controller.

## Operation:

The controller will automatically turn on when you switch on the power to your data logger. The sensor heaters require approximately 30 seconds to warm-up. You must turn the power on to the controller early enough that the sensors have time to warm-up. While the sensors are warming up they will output a data value of  $-0.10$  on the VNET bus. If this value is recorded during the run this means you need to turn the power on to the data logger earlier.

The two status LED's on the controller are used to determine the state of the controller and sensor as follows:

OPERATION	STATUS LED 1 RED COLOR	STATUS LED 2 GREEN COLOR
Sensor warming up	Slow flash	Off
Sensor is at operating temperature and controller is ready	Solid	Off
Sensor is not connected or controller error	Fast flash (3 per second)	Off
Calibration button was pushed, controller is waiting for a second button press on the calibration button to confirm free air calibration request. Will timeout in 10 seconds if not confirmed.	Off	Fast flash

## Free Air Calibration using the CALIBRATE Button:

It is recommended to periodically perform a free air calibration to correct for sensor wear caused by leaded fuels and aging. Before starting a free air calibration, the sensor must be removed from the exhaust and exposed to open air. A free air calibration can be initiated by following the instructions below.

NOTE: If the CALIBRATE button is not readily accessible, you can also perform a free air calibration using the DataLink software.

- 1) Remove the sensor from the exhaust pipe.
- 2) Turn on the controller and wait for the red status 1 LED to go solid.
- 3) Press the CALIBRATE button on the controller. The red status 1 LED will go out and the green status 2 LED will begin to flash.

- 4) Press the CALIBRATE button again, within 10 seconds, to confirm that you want to perform a free air calibration. The green status 2 LED will go solid for about 1 second while performing the calibration. The red status 1 LED will turn back on solid when finished.

### **Programming the Analog Output Scale Using the CALIBRATE Button:**

You can use the CALIBRATE button on the controller to select between three different analog output scales. The default scaling is 8 to 18 AFR for gasoline which is the equivalent to 0.544 to 1.225 lambda. You can also chose 9 to 16 AFR or narrowband simulation. Narrowband simulation is used to simulate the signal of the standard one to three wire oxygen sensor found in most OEM applications.

To program the analog out using the CALIBRATE button on the controller, perform the following procedure:

- 1) Press and hold the CALIBRATE button while turning on the power. Hold the button until the red and green LED's are both on solid then release.
- 2) The status 1 and status 2 LED's will begin to flash a code. The number of times the green status 2 LED flashes between the red status 1 LED flash corresponds to the analog output scale. See the table below.
- 3) Press the CALIBRATE to change the analog output scale and the number of green LED flashes.
- 4) When you have selected the desired scale, press and hold the CALIBRATE button until the green LED stops flashing and the red LED goes solid.

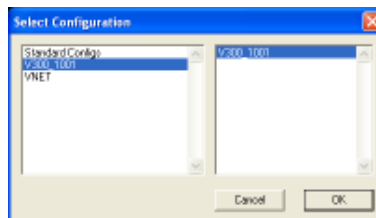
Number of Green LED Flashes	Analog Output Scale AFR for Gasoline
1	0v =8 AFR 5v=18 AFR
2	0v=9 AFR 5v=16 AFR
3	Narrowband Simulation
4	User Defined Scale. Can only be set using the DataLink software.

## **Software Setup and Configuration**

You must have DataLink II version 3.1.2 or higher installed in your PC. This module has been factory configured as described in the configuration box located at the top of this page. If you purchased this module as an upgrade to an existing system, you will need to update your car configuration file before you will be able to access the information from this module. Please refer to the setup instructions below. If this module was purchased with a complete data logger system from Racepak and it is not an upgrade to an existing system, no further setup is required and you do not need to perform the steps below. However, it is highly recommended that you the read through all of the instructions to familiarize yourself the software setup procedure.

Before you can use this module as an upgrade to an existing V series data logger you will need to update the logger configuration file in your PC by following the steps below.

1. Connect your PC to your data logger via the serial interface cable that was provided with your data logger.
2. Turn the power on to the data logger and the air/fuel sensor controller.
3. Start the DataLink program on your PC.
4. Open the data logger configuration file by selecting **Open Car Configuration** under **File** from the menu bar. The following dialog box will appear.



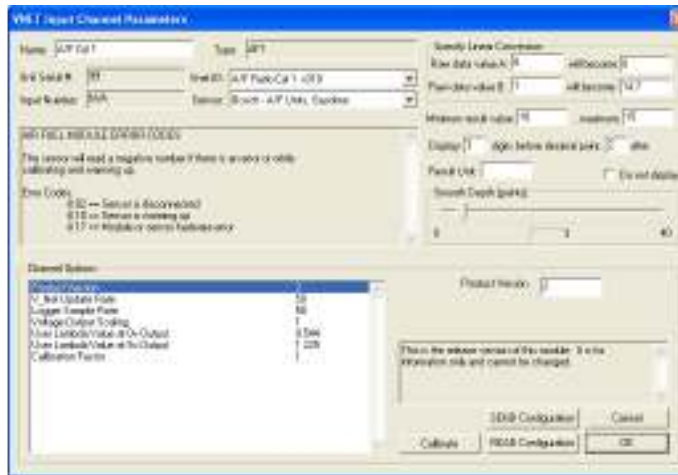
5. Select the configuration that contains your logger type and serial number. Example: V300\_1001
6. Left click on **Edit** from the menu bar then select **Read VNET Config**.

7. A message box will appear and you should see data scrolling down. When finished you should see a message stating **DEVICES READ SUCCESSFULLY**, click on the OK button. If you get any error messages check the serial cable and power connections and try again.
8. Save the updated configuration file by left clicking **File** on the menu bar and selecting **Save**.

You should now see a new channel button added to the configuration file representing this module. The button will be labeled as shown at the top of the first page of this manual. For instance, A/F Cyl 1.

### Changing the Module Setup:

The default parameters should work fine for most applications. If you need to edit the setup parameters on this module, position the mouse cursor over the button of the channel you wish to modify and click the right mouse button. The VNET Input Channel Parameters dialog box will be displayed.



### Setting the Sensor Type:

You cable program the module to output the air/fuel ratio in the following units.

- Lambda (fuel independent)
- AFR for gasoline
- AFR for methanol
- Custom units (use for fuels not listed)

To change the output units, left click on the drop down arrow button next the the box labeled 'Sensor' then make your selections. If you select the 'A/F Units, Custom' sensor type for a fuel other than gasoline or methanol, you will need to enter the fuels stoichiometric air fuel ratio value in the 'Raw data value B' 'will become' box. You will also need to enter the minimum and maximum result values. When you have fishished making all changes you must send the updated configuration to the module by following the instructions in the **Sending the Configuration to the module** section below.

### Setting the Sample Rate

The factory default sample rate is set to the maximum of 50 samples per second. If you wish to lower the sample simply change the 'V\_Net Update Rate' and 'Logger Sample Rate' to the disired value. The 'V\_Net Update Rate' should be set to value which is equal to or greater than the 'Logger Sample Rate'. When you have fishished making all changes you must send the updated configuration to the module by following the instructions in the **Sending the Configuration to the module** section below.

### Setting the Voltage Output Scaling

If you using the 0-5 volt output to read the air/fuel ratio with an older Racepak data logger that is not VNET capable or any other device you will need to know the voltage output scaling. The factory default output scaling is:

- 0 volts = 8 AFR for gasoline
- 5 volts = 18 AFR for gasoline
- AFR = (output voltage x 2) + 8

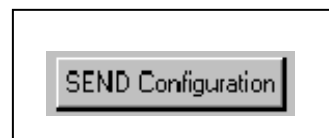
If desired you can also program the output scaling to range 9 to 16 AFR, narrow band simulation or a custom user defined range.

### Calibration Factor

This is a read only setting is automatically generated when a free air calibration is performed and is used to correct the air/fuel reading for sensor aging. A new sensor that requires no correction will show a calibration factor of zero. As the sensor ages and/or becomes poisoned with lead the calibration factor will begin to increase after performing a free air calibration. We recommend replacing the sensor when the calibration factor exceeds 10. However, this does not mean the sensor will not continue to perform and is completely up to you and your budget. **In order to correctly read the calibration factor you must first perform a free air calibration, then click on the Read Configuration button to read back the calibration result.**

### Sending the Configuration to the module:

When you have finished editing the configuration on your PC, you will need to send the information to the sensor module. Be sure the serial interface cable is connected to your data logger and power is applied to the system. To send the information position the mouse cursor over the **Send Configuration** button and click the left mouse button. The progress box as shown below will be displayed.



When finished sending the message “**Device Programmed Successfully**” should be displayed at the bottom of the progress box. If you receive an error message, turn power to the system off and then back on and repeat the send configuration process. If problems persist contact RacePak.

Save the configuration file to disk and update the Module Configuration Setup Box on the front of this worksheet with the new setup configuration.

### Free Air Calibration using DataLink:

It is recommended to periodically perform a free air calibration to correct for sensor wear caused by leaded fuels and aging. Before starting a free air calibration, the sensor must be removed from the exhaust and exposed to open air. A free air calibration can be initiated by following the instructions below.

NOTE: You can also perform a free air calibration by pressing the CALIBRATE button on the controller.

1. Connect your PC to your data logger via the serial interface cable that was provided with your data logger.
2. Turn the power on to the data logger and the air/fuel sensor controller.
3. Start the DataLink program on your PC.
4. Open the data logger configuration file by selecting **Open Car Configuration** under **File** from the menu bar. The following dialog box will appear.



5. Select the configuration that contains your logger type and serial number. Example: V300\_1001
6. Right click on the channel button of the A/F channel you wish to calibrate.



7. The VNET Channel Input Parameters dialog box will open. Click on the ‘Calibrate’ button in the lower right hand side of the dialog box.



8. The status of the A/F channel will be displayed at the bottom of the dialog box. Before performing a calibration, make sure the sensor is not still warming up and that there are no errors. The Heater Calibration button is not used. If you have installed a new sensor in this channel perform a free air calibration. When you have finished click on the OK button to exit.

**IMPORTANT!!**

You must remove the sensor from the exhaust and expose the sensor to open air before performing a free air calibration. After removing the sensor from the exhaust, wave the sensor back and forth a few times to be sure all of the exhaust gases are purged from the sensor.

## Troubleshooting

There are two method used to indicate that there is an error on one or more channels.

1. The channel will output a negative value to indicate an error. If the recorded data shows a negative value, the data is invalid.
2. The LED on top of the controller does not go solid after a few minutes and is flashing quickly, about 5 flashes per second. This indicates that an errors has occurred on one or more channels.

PROBLEM	RECOMMENED SOLUTION
I get a negative reading.	A negative reading indicates an error has occurred. Look at the error code chart below to determine the exact cause of the error.
The red status 1 LED never stops flashing.	A continuously fast flashing status 1 LED indicates that an error has occurred. This is most likely caused by an unplugged or damaged sensor.
I am using the sensors with methanol and the reading are very lean.	The factory default configuration is set to output air fuel ratio units for gasoline. Follow the steps outlined in the 'Software Setup and Configuration' section to set the sensor type to 'A/F Units, Methanol'