LCU-ONE

LAMBDA CONTROLLER MANUAL

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1 – LCU-ONE Overview

The LCU-ONE is a wide band controller for the BOSCH LSU 4.9 Lambda sensor, well suited for gasoline and diesel engines.
This controller is to be intended to control the Lambda sensor and to measure the AIR/FUEL ratio (AFR) or Lambda value for an engine.

Both analog and digital (CAN) outputs are provided for Lambda and AFR.

The Lambda value is the actual air fuel ratio over the AFR stoichiometric ratio.

The AFR stoichiometric is the theoretically optimal air/fuel ratio where all available oxygen in the air combines with all available fuel.

For gasoline-driven engines, the stoichiometric ratio is 14.57 pounds of air for every pound of fuel; the LCU-ONE measures Lambda value from 0.65 to free air.

We remind you that a Lambda value < 1 indicates a rich mixture while a Lambda value > 1 indicates a poor mixture.

Wide band sensors need to be heated to work properly thus the LCU-ONE manages the sensor heater in order to maintain the sensor at the right temperature.

Using the CAN bus, the LCU-ONE provides information regarding sensor temperature and heater diagnosis to indicate fault condition like open load, short circuit to ground or short circuit to power supply.

Lambda value is provided by a configurable 0-5 Volt analog output.

Lambda value/AFR, the sensor's temperature and the diagnostic are provided via CAN bus too.

The oxygen sensor used with the LCU-ONE controller gets very hot (about 500°C-600°C) during it's operation, so AVOID :

- TO TOUCH IT.
- THE SENSOR TO TOUCH FLAMMABLE MATERIALS OR FUEL.

Failure to respect this precautions may result in burns or explosions.

2 - Mounting the LCU-ONE

Find a flat location far away from the exhaust gas system where you can install the controller by the means of the provided holes.

Fit the harness on the engine space or inside the car away from heat source.

Using the CAN bus, remember to use the CAN line termination.

(For this feature there is the CAN line termination connector). That comes with the installation kit.

3 - LCU-ONE Power Supply

The LCU-ONE needs a 10 to 15 Volt CC power supply to work properly. The controller manages the heater of the sensor that requires about 15-20 Watt: be sure that the controller power is under the main switch, in order to avoid energy absorption from the car battery while the engine is off.

The cabling must be:

-GND CABLE (BLACK) - Connect it to a gnd plane on the vehicle, better if directly on the battery negative pole.

- POWER SUPPLY (RED) - Connect it to a 12 Volt CC power supply under the main switch, **protected by an external fuse of at least 5 ampère.**

In case you need to extend power supply cables, please use cables with a section of at least 1,34 mm^2.
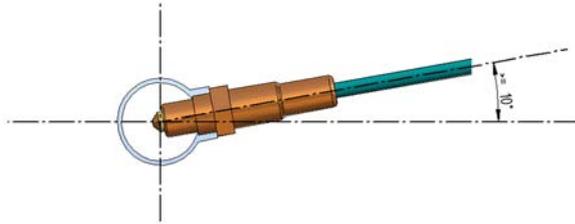
4 – Mounting the Lambda sensor

The BOSCH LSU 4.9 Lambda sensor is to be installed on the exhaust gas system by using an apposite adaptor.
The sensor must be closer to the engine.

The temperature must be lower than 1652 °F, and the probe itself must not be exposed to free flame coming from the exhaust system. In a point where representative exhaust gas composition is guaranteed at a temperature lower than 1652 °F.

The maximum temperature at the sensor bung (the sensor hexagon) should be lower than 1112 °F.
If this temperature is exceeded, you should install a

proper heat sink. Installation angle must be inclined at least 10° towards horizontal (electrical connection upwards), in order to preventing the collection of liquids between sensor housing and sensor element during the cold start phase.

At the end of the installation, connect the 6 pin male connector of the sensor with the respective female on the controller harness and be sure that the harness is located far from the exhaust gas system .
The use of cleaning/greasing fluids or evaporating solids at the sensor plug connection is not allowed.

Never switch the engine on when the sensor is not powered by an LCU-ONE controller: an unheated sensor exposed to exhaust gas flow will be corrupted.

The LSU 4.9 sensor is built to operate with unleaded fuel or diesel engines. It is possible to use the sensor with other fuel but the life cycle of the sensor must be verified by the customer with adequate tests.

5 - Connecting LCU-ONE to a dash

The LCU-ONE can be connected to dashes and datalog-gers in two different ways :

By analog output and by CAN bus.

In the first case you have only Lambda value represen-ted by a configurable voltage from 0 to 5 Volt.
In the second case you have much more information like Lambda value, AFR, sensor's temperature and dia-gnosis.

Analog output is not designed to supply other devices or sensors.

So using analog output on this manner, will result in a damaged controller.

According to the instrumentation you want to use for display/logging, be careful to order the right harness: all available harnesses are listed in appendix A.

6 – Configuring the LCU-ONE

The LCU-ONE by default is programmed to have on the analog output a Volt value three times the Lambda value for Lambda between 0.65 and 1.6.

Moreover, default values for WarmUp phase and error phase are respectively 3 Volt (Lambda = 1) and 1.5 Volt.
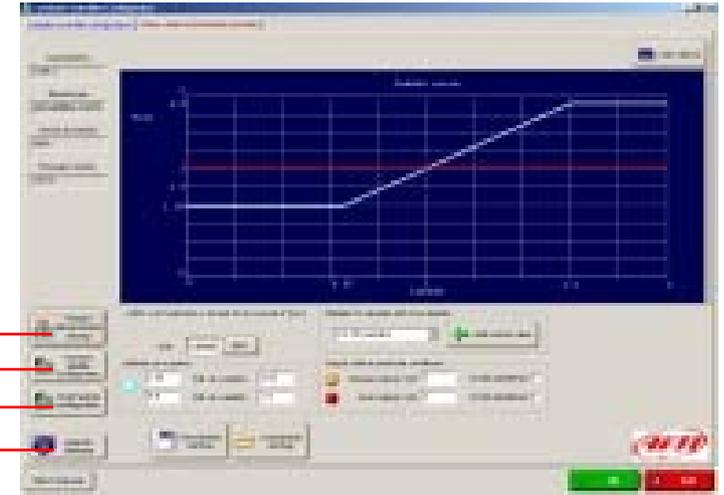
The AFR default value is fixed in 14.57 (for unleaded gasoline available on the market).

For different values (not the default ones), you can use the dedicated configuration software to modify the following parameters:

- Lambda / voltage values
- WarmUp and error conditions values
- Stoichiometric ratio for different fuels

7 – Software

Button 1
Button 2
Button 3
Button 4

There is also a secondary window called "online" where is possibile to see in real time Lambda value, AFR, sensor's temperature, battery voltage and the

heater diagnosis to indicate fault condition like open load, short circuit to ground or short circuit to power supply.

When the software starts, it searches for any LCU-ONE connected and powered up on any COM port. When a controller is found, the COM number, the instrument type, the identification number and the firmware version appear.

The buttons on the left allow:

- Button 1 : To restore default configuration
             (you need to transmit configuration
              to take effect)
- Button 2 : To transmit the configuration.
- Button 3 : To read the configuration from
             the controller.
- Button 4 : To transmit an updated firmware
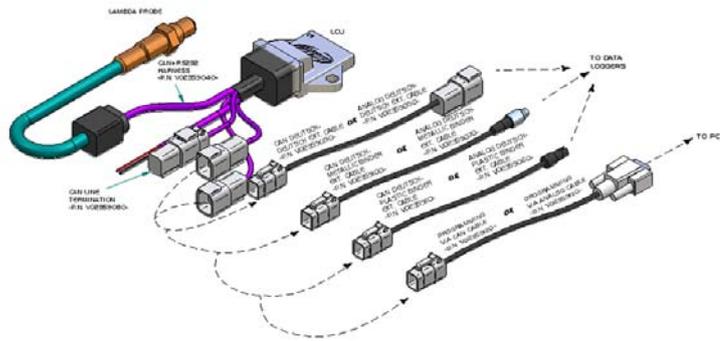   to the controller.

Moreover, there are four editable fields to configure:

- Analog output values according to Lambda values or AFR.

- Stoichiometric ratio of the used fuel (you can choose among different standard values or you can edit your own value).

- Analog output level on sensor WarmUp phase and error phase, or analog output setting in high impedance for both WarmUp and error phases.
In this latter case, analog output value is not defined.

8 – Part Numbers

LCU-ONE Controller	**X08LCUONE02A**
BOSCH LSU 4.9 lambda sensor	**X05LSU490**
ANALOG + RS232 harness	**V02359010**
CAN + RS232 harnes	**V02359020**
ANALOG + CAN + RS232 harness	**V02359040**
ANALOG – DEUTSCH patch cable	**V02359050**
ANALOG – Plastic Binder patch cable	**V02359060**

ANALOG – Metallic Binder patch cable	**V02359070**
CAN – DEUTSCH patch cable	**V02359090**
CAN – Metallic Binder patch cable	**V02359100**
CAN – Plastic Binder patch cable	**V02359110**
CAN line termination	**V02359080**
Programming via CAN patch cable	**V02359120**
Programming via ANALOG patch cable	**V023590130**

9 - Dimensions