

**User Manual**  
**LCU-ONE CAN**  
**connected to**  
**MXL-EVO3 Pro/Pista**



**Racing Data Power**

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## Chapter 1 – LCU-ONE Description

**LCU-ONE** is a lambda controller unit for wide band BOSCH LSU 4.9 lambda probe. It fits petrol (2 and 4 strokes), diesel and methane engines as well as alcohol based fuel engines. It is intended to check lambda probe proper working as well as to transmit the Air/Fuel Ratio values providing **MXL/EVO3** with lambda values through the CAN bus.

Lambda value is defined as:

$$\text{LAMBDA} = (A/F) / (A \text{ Stoichiometric} / F \text{ Stoichiometric})$$

where:

**A** = incoming parts of air;

**F** = parts of petrol the carburettor injects into the engine;

**A Stoichiometric / F Stoichiometric** = parts of air needed to burn Stoichiometric F;

Speaking about gasoline, for example, it needs 14,57 parts of air to completely burn a part of gasoline, obtaining Lambda value = 1 read by the probe.

**LCU-ONE** controller can detect lambda values in a range of 0.65 to 1.6 (free air).

**It is reminded that LAMBDA value lower than 1 means a rich mixture, while LAMBDA value higher than 1 means a lean mixture.**

It is necessary to heat the wide band Lambda probe so that it works properly and is not poisoned with exhaust gas. **LCU-ONE** precisely manages the probe heater so to keep temperature value in the optimum working range.

**During its working period, Lambda probe used with LCU-ONE becomes very hot (around 700-800 °C that is 1292-1472 °F); it is thereby necessary AVOIDING:**

- touching it.
- placing it in contact with flammable stuff or fuel.

**Please note: disrespect of these precautions can cause shocks, burnings or explosions.**

## Chapter 2 – LCU-ONE and Lambda probe mounting

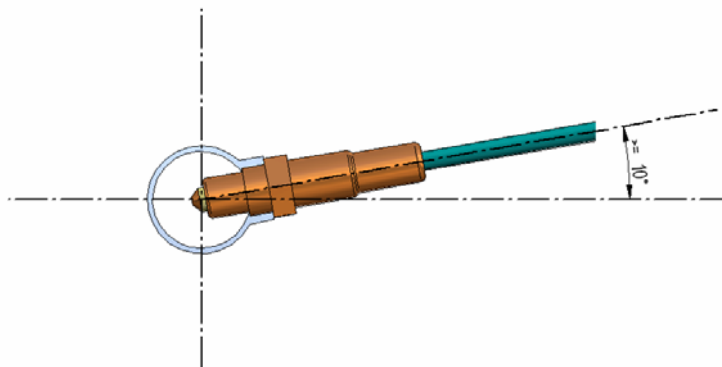
**LCU-ONE** controller should be installed in a flat location and far from heat sources. It should be mounted steady using the supplied bracket.

The wiring has to be arranged so to avoid it passing near to heat sources.

BOSCH LSU 4.9 Lambda probe should be installed on the vehicle exhaust pipe using a specific adaptor that comes with the kit and should be welded on the same pipe. The probe should be sufficiently near to the engine.

Probe working temperature should not exceed 900°C (1652°F) and it should not be exposed to the free flame coming from the exhaust system.

Probe installation angle should be of at least 10° to avoid liquid condensation stuff to come in contact with the probe, polluting it.



Once the probe is installed, pay attention not to let the cable pass near to excessive heat sources (the exhaust pipe for example).

Bosch LSU 4.9 probe auto-calibrates: no calibration is then required to the user.

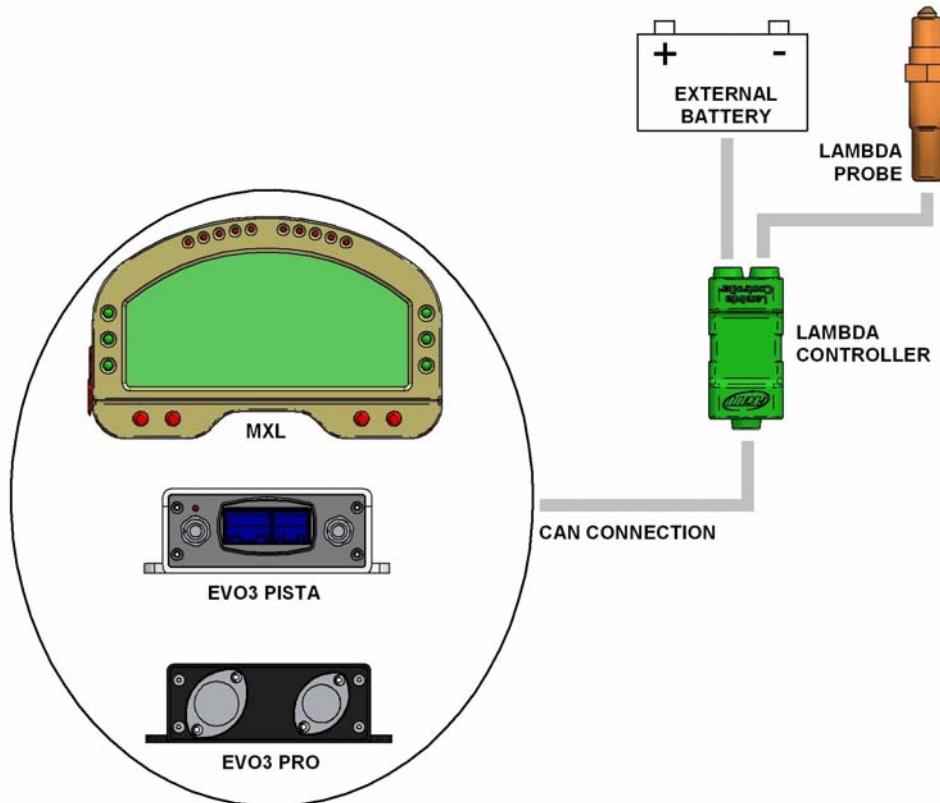
**Solvents or additives should not be used to clean the probe connector. To protect the probe we would suggest to remove it when cleaning the vehicle to avoid polluting the probe with detergents.**

It is reminded to never switch the vehicle on with Lambda probe installed and not connected to a correctly working **LCU-ONE** controller: a probe not heated and exposed to exhaust gas would be irremediably damaged.

**N.B.** BOSCH LSU 4.9 Lambda probe has been designed to be used with unleaded or diesel engine. It can be used with other kind of engines too, but its duration needs to be verified by the user with specific tests.

## Chapter 3 – Connection with MXL – EVO3 Pro/Pista

### 3.1 – Connection of LCU-ONE CAN

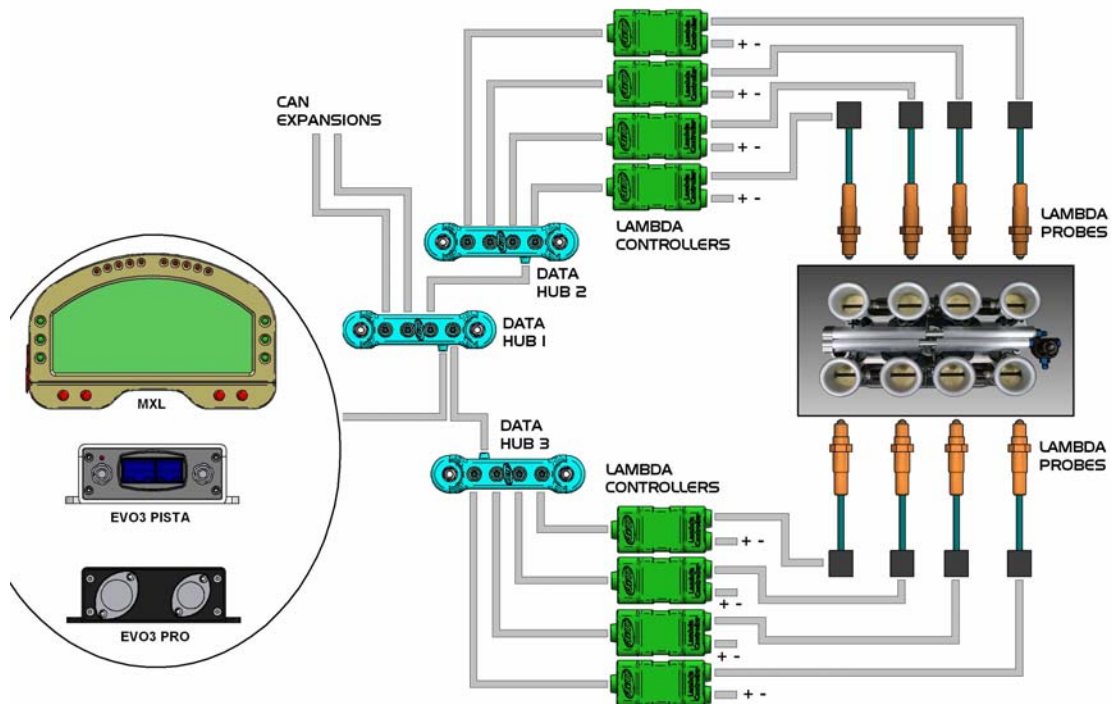


To connect Lambda controller only, the connection scheme is the one showed above. To protect Lambda Controller we would suggest to insert a 10 A fuse for each Controller in series between external battery and Lambda controller.

**LCU-ONE CAN is to be powered – like the logger - by the engine master switch.**

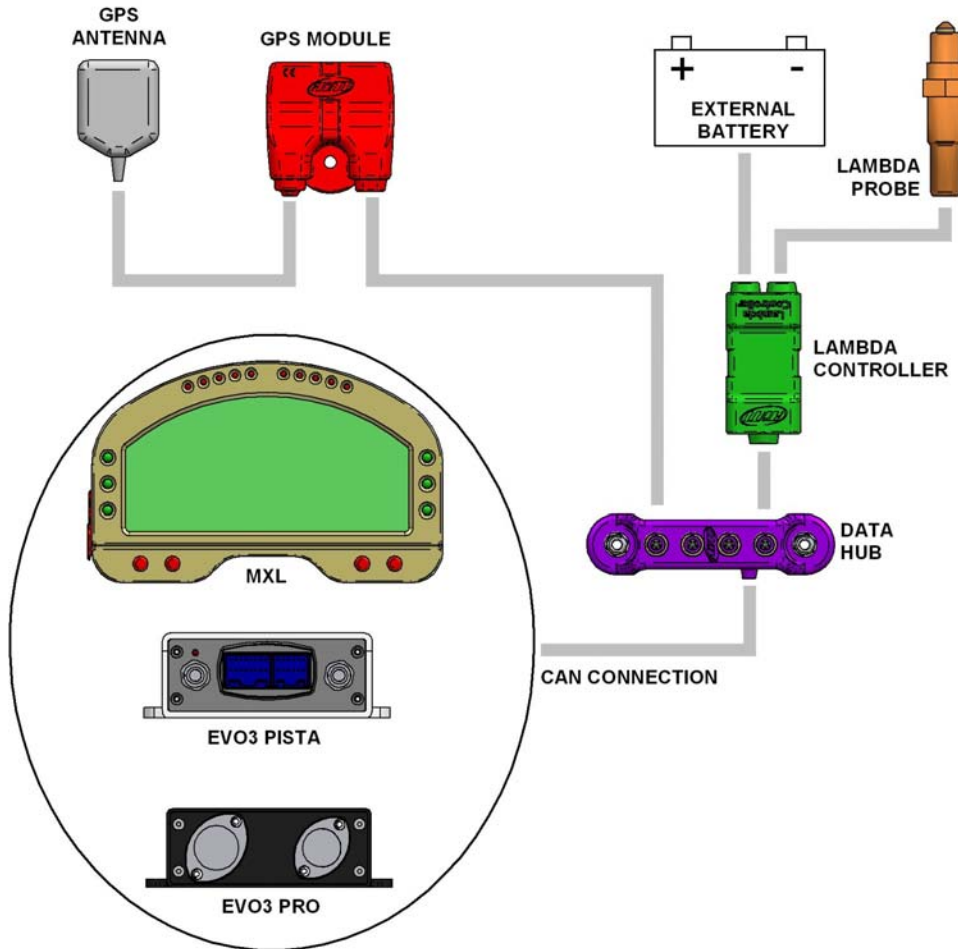
As far as connection with the loggers is concerned, refer to each system user manual.

In case more than one **LCU-ONE** has to be connected, for a better engine control (one probe for each engine bank or even one probe for each engine cylinder), the peripherals connection scheme to follow is shown below:



Each Lambda controller has to be connected to the battery.  
 We would suggest to protect each Lambda controller with a 10A fuse.  
 When **MXL/EVO3** is switched off all peripherals are automatically switched off.

### 3.2 – Connection of LCU-ONE CAN + GPS MODULE



In case Lambda controller is to be connected with other CAN peripherals, connection scheme is the one shown above.

We would suggest to insert a 10 A fuse in series between external battery and Lambda controller to protect the latter.

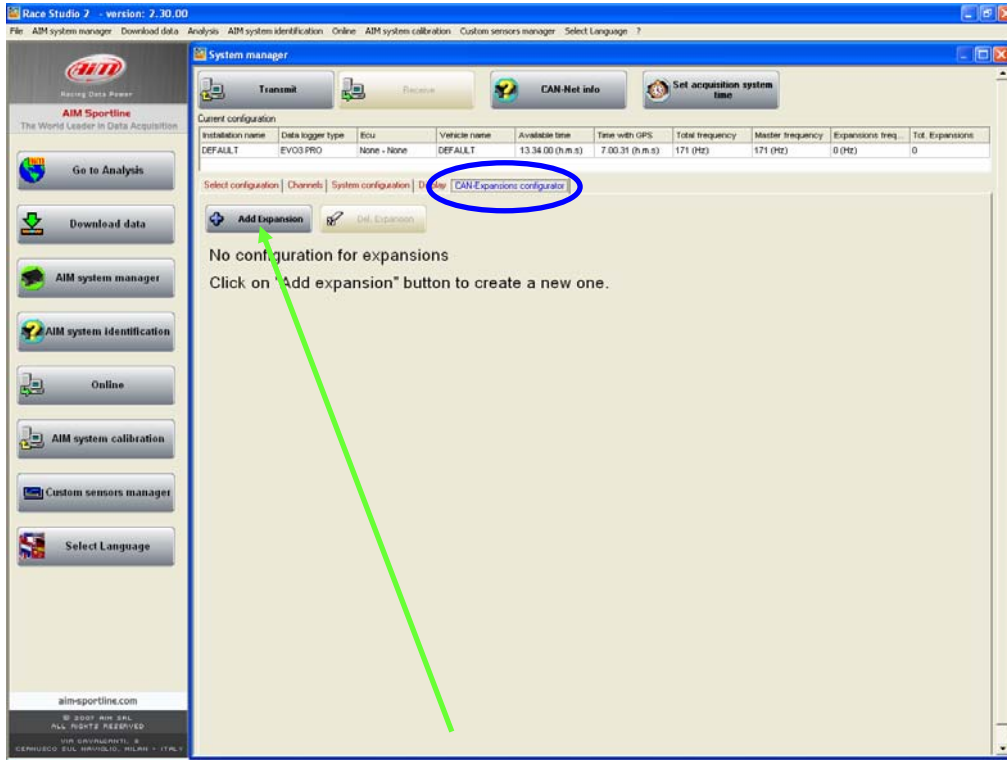
As far as connections with the logger is concerned, refer each system user manual.

## Chapter 4 – Configuration on MXL – EVO3 Pro/Pista

To be used with **MXL/EVO3**, **LCU-ONE CAN** needs to be configured through **Race Studio 2** software. Refer to the installation manual for further information about the software and to the loggers manual for further information about their configuration.

It is suggested to configure **LCU-ONE** keeping it connected and switched on.

Run the software and select the desired logger: **MXL** or **EVO3 PRO/Pista**. The figure shown below appears. Select “**CAN-Expansions Configurator**” layer. In case of very first configuration the layer appears empty as shown below.

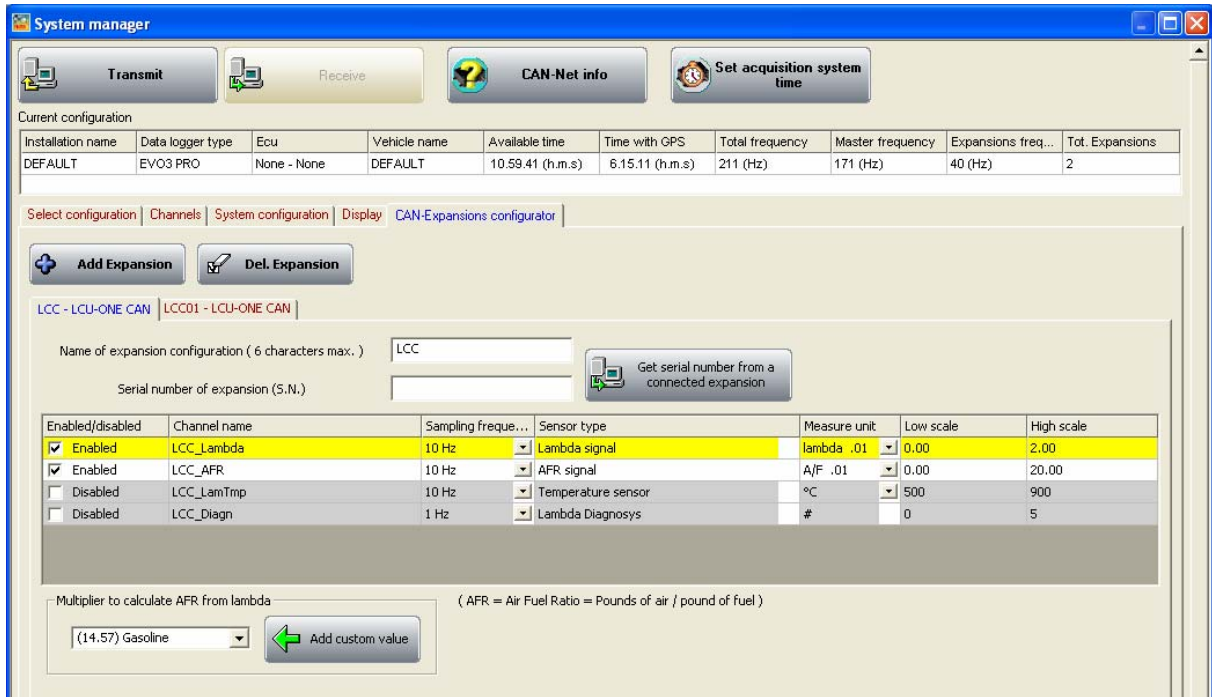


Press “Add Expansion” button and this window appears:



Select **LCU-ONE CAN (only CAN)**. The fields under the keyboard enables, press “Get serial number from a connected expansion” and the system gets the serial number of the connected **LCU-ONE**. It is also possible to insert this information manually keeping it from **LCU-ONE**.

This operation is to be repeated as many times as many **LCU-ONE** are connected. The layer will be modified adding as many new layers as many **LCU-ONE** have been added.



In case serial number has not been get, press “Get serial number from a connected expansion” button.

**Warning: this operation is necessary to be able to transmit the configuration to the logger.**

LCU-ONE layer is shown above.

### On top

Name of expansion configuration (6 characters max.) and serial number fields. Inserting a configuration name the layer label is modified live. As far as serial number is concerned, see previous paragraphs.

**Central in the page** a table shows LCU-ONE channels. The table has 7 columns.

*Enabled/Disabled:* shows the channel status (enabled/disabled) and can be modified checking or un-checking the related checkbox. LCC\_lambda (lambda value) and LCC\_AFR (AFR value) channels are enabled by default.

*Channel name:* shows the channel name and can be modified double clicking on the cell that becomes editable.

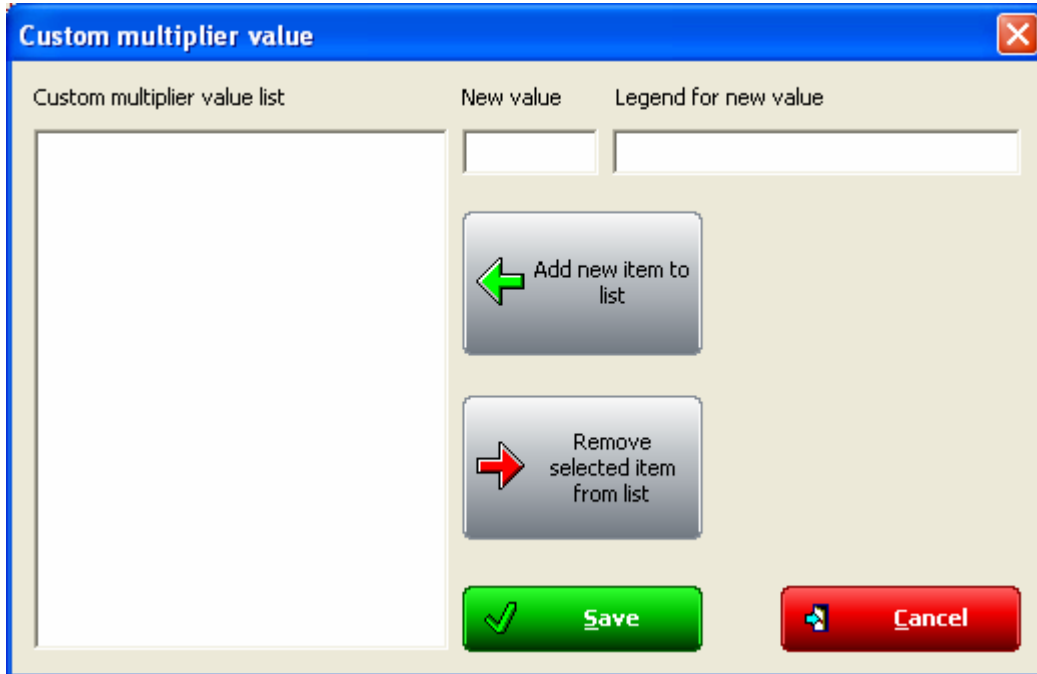
*Sampling frequency:* shows the channel sampling frequency and can be set selecting the desired value from the pop up menu that appears double clicking on the cell (accepted values are from 1 to 50 Hz).

*Sensor Type:* shows the sensor installed on that channel and can not be modified.

*Measure Unit:* shows the selected unit of measure of that channel and can be modified double clicking on the cell.

*Low/High scale:* shows the channel high and low scale and can be modified double clicking on the cells, that become editable.

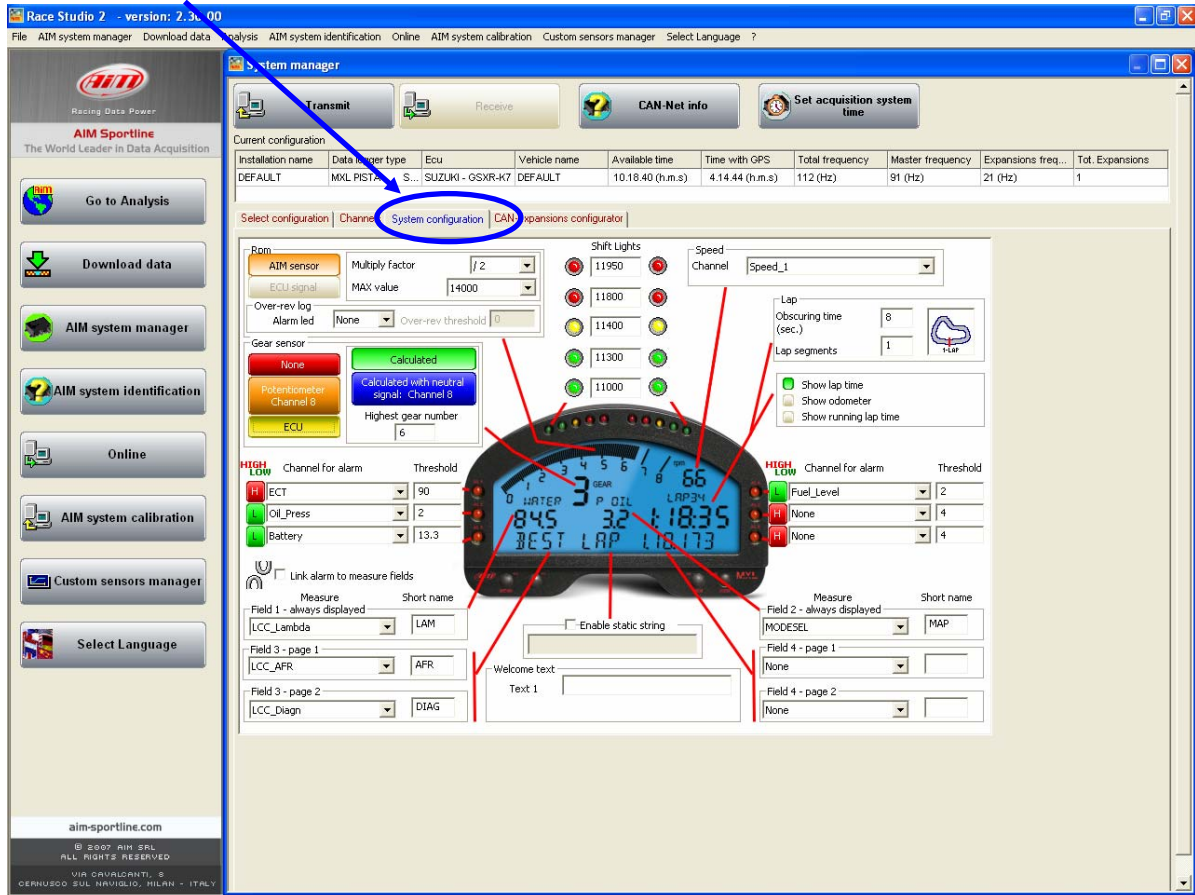
**Under** the table is “Multiplier to calculate AFR from lambda” field. It allows the user to change the used fuel and to insert a new one. Select the used fuel to see its AFR value. In case a fuel not included in the database is being used and **only in case its Stoichiometric value** is known press “Add custom value” button and the window shown below appears.



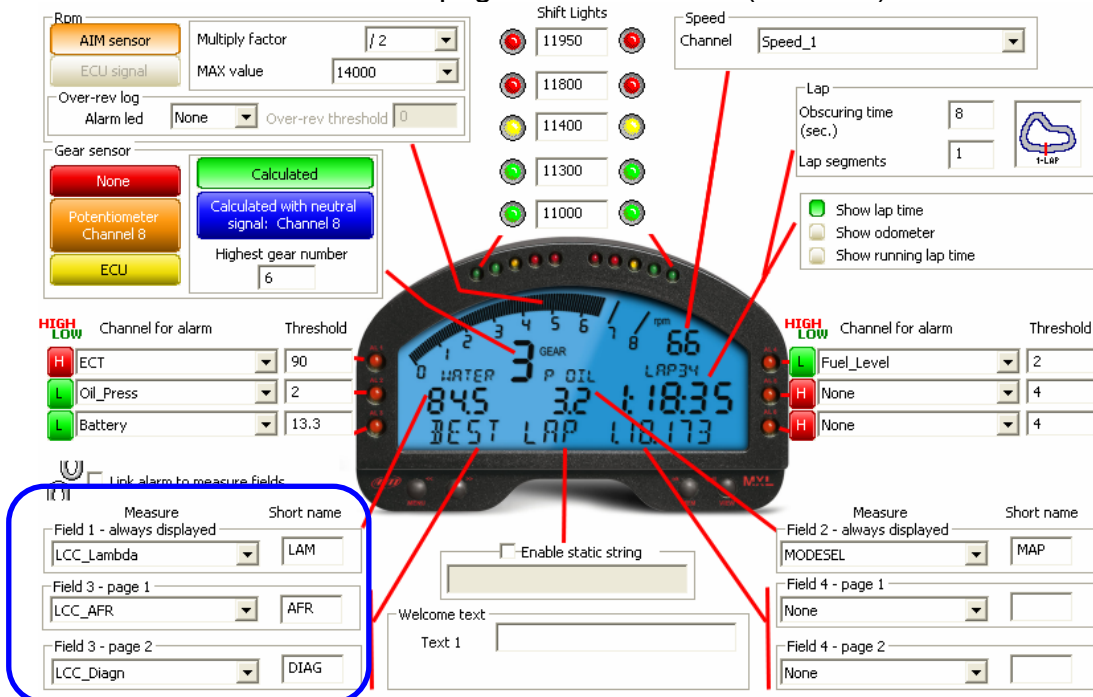
Fill in the window with Multiplier value and related legend. Press “Add new item to list” and then “Save” button.

Likewise, select a multiplier from the left box labelled as “Custom multiplier value list” and press “Remove selected multiplier from list” button to remove a multiplier.

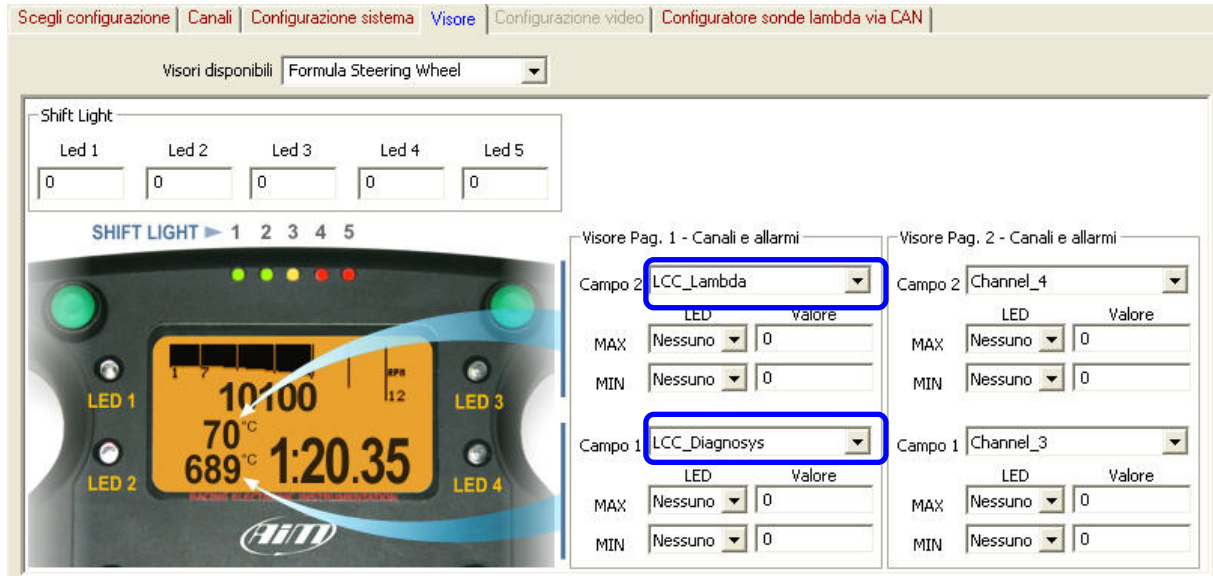
Once enabled/disabled the channels, it is possible to show Lambda channels on the display depending on the logger and on the connected peripherals. In case of an **MXL**, Lambda channels can be shown setting them in “System Configuration” layer



In the example below **LCU-ONE** enabled channels are: LCC\_Lambda, LCC\_AFR and LCC\_diagnosis and each one can be shown in a field of the display. The example shows the three channels set on page 1 and 2 of MXL (blue box).



In case of an **EVO3**, data visualisation is possible only connecting the logger to a **Formula Steering Wheel** or to a **MyChron3 Dash** and the channels to show are set in the display configuration as shown below.



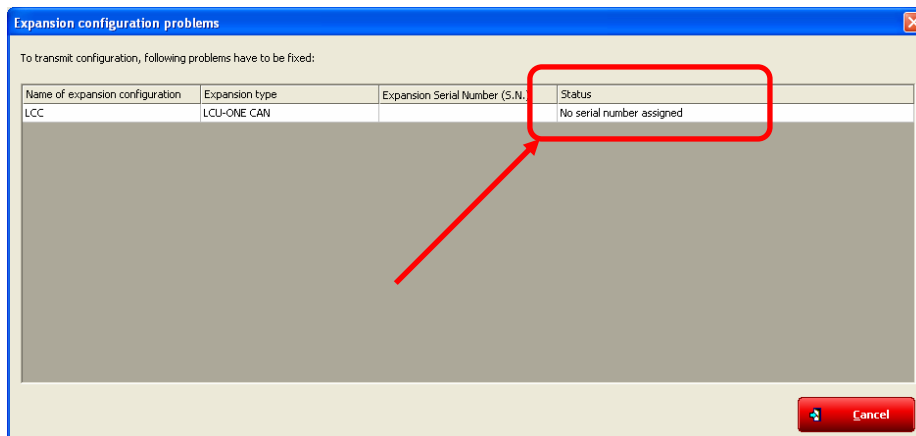
**Note:** LCC\_diagnosys channel shows LCU-ONE working status and can show up to four messages:

- 0: status OK
- 1: probe not connected
- 2: +12V short circuit
- 3: GND short circuit

The configuration is now ready to be transmitted to the logger.

**Warning:** the configuration is to be repeated on all LCU-ONE connected to the logger.

Once all parameters have been set and fields assigned, the configuration needs to be transmitted to the logger pressing “Transmit” button on **Race Studio 2** top keyboard. If the transmission is ok no message is shown. If, on the contrary, **LCU-ONE** serial number has not been get, this window appears.



It tells the user that no serial number has been assigned to the connected expansion. Close this window pressing “Cancel” button and get the expansion serial number as explained in the previous pages.

## Chapter 5 – Data Visualisation on MXL/EVO3

### 5.1 – Data Visualisation on MXL

Lambda channels visualisation on **MXL** works exactly like the visualisation of any other **MXL** channel and switch from one page to the other is made using “MEM/View” button. Please refer to **MXL** user manual for further information. In the figure below lambda value is **0.95** and assigned Short Name is **LAM**.



Switching **MXL** on, Lambda controller is recognised at start-up and probe Warm-Up procedure starts. During this period, the controller takes the probe to its working temperature (until around 780 °C – 1436 °F).

During warm-up (around 20-30 seconds), displayed lambda value is 1.00.

When the probe is 100% working, displayed value turns, with the engine off, into 1.60 (free air value).

**Warning: it is reminded that LCU-ONE CAN is to be powered – like the loggers - by the engine master switch.**

### 5.2 – Data Visualisation on EVO3

Lambda channels visualisation on **EVO3** works exactly as the visualisation of any other **EVO3** channel and is thereby possible only if the logger is connected to a display. The only displays that show Lambda value are **MyChron3 Dash** and **Formula Steering wheel**. Refer to **EVO3** user manual for further information. In the figure below Lambda value is 0.95 and the field is labelled as “λ”



Switching **EVO3** on, Lambda controller is recognised at start up and probe Warm-Up procedure starts. During this period the controller takes the probe to its working temperature (until around 780 °C – 1436 °F).

During warm-up (around 20-30 seconds), displayed lambda value is 1.00.

When the probe is 100% working, displayed value turns, with the engine off, into 1.60 (free air value).

**Warning: it is reminded that LCU-ONE CAN is to be powered – like the loggers - by the engine master switch.**

## Chapter 6 – Data Analysis with Race Studio Analysis

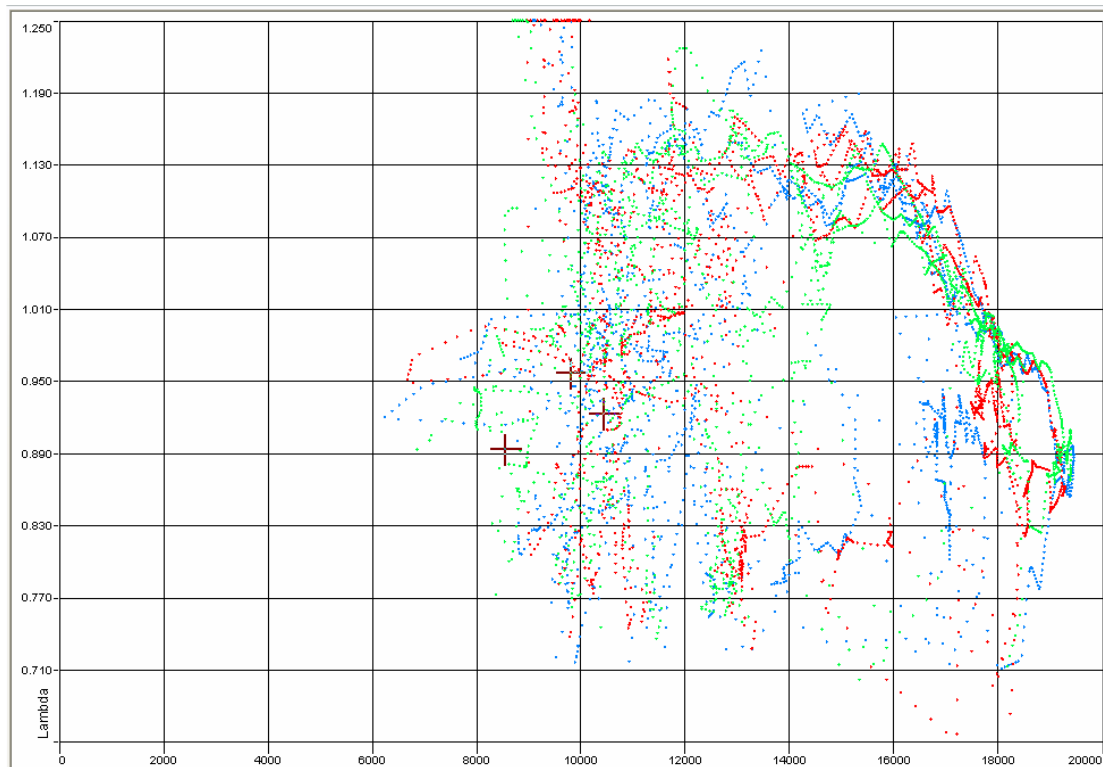
During data analysis, the presence of Lambda controller adds as many channels as the number of **LCU-ONE** channels enabled to Measures and laps toolbar (as shown in the figure below):

**Lambda** : shows lambda value recorded during the session;

**Lambda\_Temp**: indicates the probe internal temperature while working;

Misure e giri					
Misure	Giri	Modelli			
<b>LONATO NICO</b>			13	14	
<input type="checkbox"/>	Engine		10448	9819	
<input type="checkbox"/>	Datalogger_Temp		2	2	
<input type="checkbox"/>	Battery		11.9	11.9	
<input checked="" type="checkbox"/>	Lambda		0.92	0.96	
<input type="checkbox"/>	Lambda_Temp		778	783	

To better analyse carburettor values, it is suggested to show XY diagram of Lambda probe with RPM values on abscissa axle and Lambda values on ordinate axle. In this way a more immediate reading of carburetion status is available.



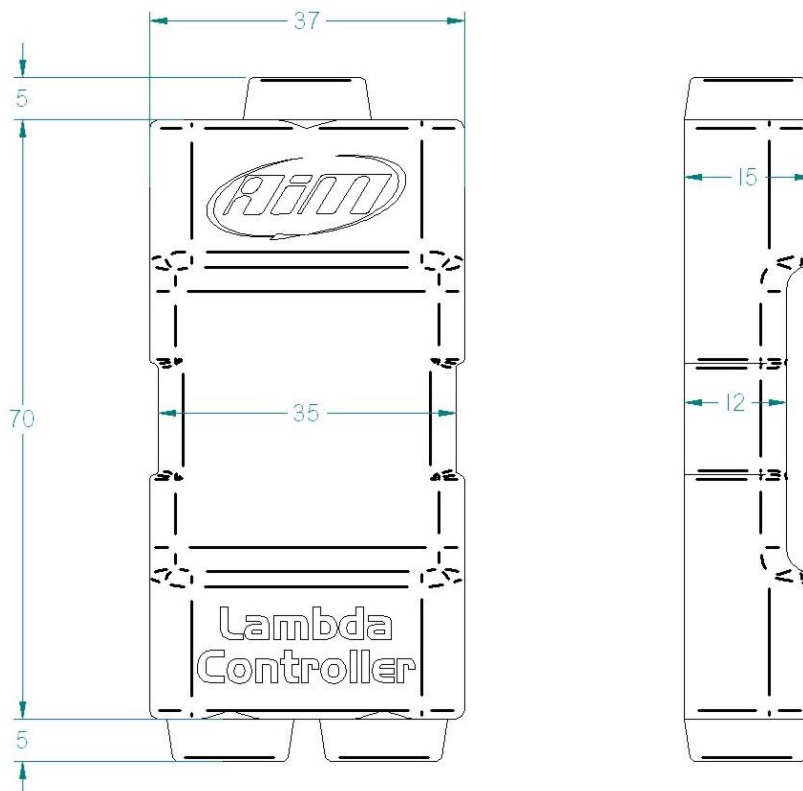
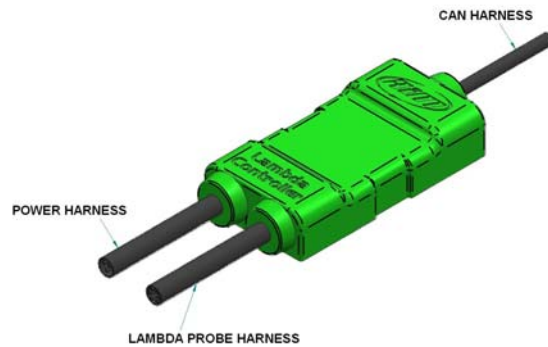
## Appendix – Part Numbers and technical drawings

### “A” – Part Numbers

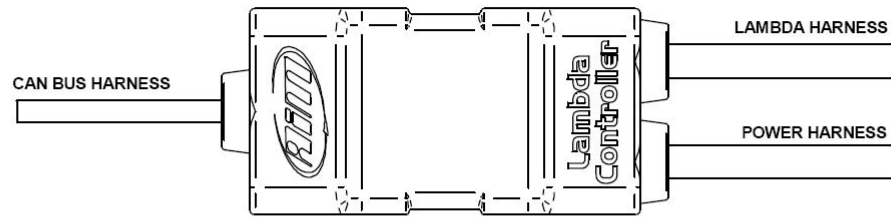
Controller **LCU-ONE** (complete kit with Lambda probe) X08LCU03K0

Lambda probe BOSCH LSU 4.9 X05LSU490

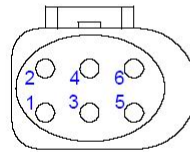
### “B” – Technical drawings



## LCU-ONE CAN pinout



CAN BUS HARNESS	
1	CAN+
2	GND
3	+Vb
4	CAN-
5	Vbext



LAMBDA HARNESS	
1	IP+
2	IP-VS
3	H-
4	H+
5	Rcal
6	VS+

POWER HARNESS	
red	V battery
black	GND
black	GND